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AVIATION

The Oldest American Aeronautical Magazine

THE *N. A. C. A.* MEETS THE *Industry*

PROBLEMS OF *Alaskan Photography*

Airplane AND *Engine* SPECIFICATIONS

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AVIATION

The Oldest American Aeronautical Magazine

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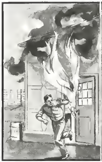

Unretouched photograph showing no damage from fire other than blistering of paint.

On the other side of the Steel Wall the machine shop blazed but the planes were PROTECTED in this ALL STEEL HANGAR

A BIT of hot solder, accidentally dropped into an open receptacle containing gasoline, caused an instantaneous and terrifically hot fire in the machine shop located in a lean-to of the Lansdowne Field hangar at Youngstown, Ohio.

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AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZIN

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EDWARD P. WARNER, *Editor*

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Show Value, How Much, To Whom, and When?

THAT AIRCRAFT SHOWS are of value is a foregone conclusion The extent of that value and to whom is a horse of a different hue Ou one side we hear that shows are of great sales value, but there are too many of them On the other side we hear that they are of great educational value, and that there should be more shows and better located Regarding the question of too many shows or too few we take no sides at this time We shall endeavor to concentrate on the value, how much, to whom, and when?

For the last three years, aircraft shows have attracted hundreds of thousands of members of the general public Attendance records have been broken and rebroken And in most of the principal cities of this country, Mr and Mrs John Citizen have become fairly well acquainted with the airplane as it is on the show floor Therefore we may take it that aircraft shows have been of considerable educational value to the public The public, however, did *not* make those aircraft shows of financial value to the exhibitors The public paid its fifty or seventy-five cents, took a good look at things, gained some first-hand knowledge, and then went its way with purse-strings tied securely.

We of the industry used to think that the public was airminded, and that a great profitable market was there for the taking In time we woke up to find that we were selling our neighbor, and that the public market was but a fanciful dream yet to be realized We now admit that we were wrong And, as the saying goes to admit that we were wrong is no crime, it is but saying that today we are wiser than we were yesterday Therefore, insofar as the public is concerned, aircraft shows are of great educational value, and of practically no financial value to the industry which is exhibiting its products

In due time, and may that time be not far distant, the public will unloosen its purse-strings at aircraft shows as it does at automobile shows now However, at present we are confronted with the fact that the best that we can hope for from the public at aircraft shows is a few leads that may or may not result in cash sales at a later date Yet, on the other hand, even though we can only expect a few leads, that does not mean that aircraft shows are not worth the industry's time and money Even if shows were of no immediate financial value to the exhibitors, the advertising and promotional opportunities offered are a consideration in themselves.

However, aircraft shows *are* of financial value to the exhibiting members of the industry As history shows us, millions of dollars worth of aeronautical equipment has been sold during show time But the idea is that ninety-nine and nine-tenths per cent of those sales were made to persons and organizations actively engaged in aeronautics, and not to the public at large Therefore, it would seem that the average exhibitor at an aircraft show has been able to cash-in in two ways. First, the opportunity to exhibit his products to the public which will constitute tomorrow's market And second, to sell for cash to his industry brothers which constitute today's market.

To sum it all up the exhibitor in today's aircraft show demonstrates to the public with one hand and buys from and sells to his neighbor with the other All of which brings up the question when is the most profitable time for the exhibitor to buy and sell with his neighbor? Attendance figures indicate to us that he can demonstrate to the public during any of the twelve months of the year Generally speaking, the season seems to play a minor part in getting Mr and Mrs John Citizen by the turnstile Aircraft show sales figures tell a different story

For the sake of illustration, let us take the figures for sales reported at the St Louis, Detroit and New York

shows. We use the word "reported" for in the aeronautic industry the word "reported" covers, among other things, a multitude of sins!

At the St. Louis show which was held February 15th to 22nd, it was reported that sales totalled in the amount of $2,500,000. Sales at the Detroit show held April 5th to 13th were reported to total $1,500,000. And for the New York show held May 3rd to 11th, total sales amounting to $750,000 were reported.

Thus it will be noted that as the year progressed sales at the shows decreased. To say that attendance had anything to do with it is immediately proved wrong by the fact that attendance at Detroit was more than double that at St. Louis. Whereas, sales at St. Louis were over one third more than sales at Detroit. As a matter of fact, the difference in attendance at Detroit and St. Louis is due largely to the former being a mechanical city and the latter a textile city. As far as New York is concerned, no such comparison can be made. It is a city of a little bit of everything, with perhaps a leaning toward to financial.

Therefore, putting attendance aside and regarding only the sales aspect of shows, it would seem, as exemplified by reports for St. Louis, Detroit and New York that the industry does its purchasing at the beginning of the year.

In other words, the active member attends the first real show of the year, takes a good look at what competitors have to offer and then gets out his checkbook and stocks up on equipment and material for the year.

That may or may not be the case. Sales figures indicate it, however. Whether a show near the end of the year would result in an even greater sales figure is something that the future will prove or disprove.

At present an aircraft show is of educational value to the public, and of advertising and promotional value to the exhibitors. What financial value it has for the exhibitors is gauged by the purchases of the brother members of the industry. And figures indicate that this purchasing powar is greatest at the beginning of the year.

//

Rundflug

COMPETITIVE air touring as an annually recurrent feature of the aeronautical calendar had its beginning in the United States, but for the concise and descriptive term that heads this paragraph, the "around-flight" we are indebted to Germany. It carries an aroma of casusl and companionable wandering, quite distinct from the businesslike atmosphere of the Ford Tour. The casualness is more in the name than in the thing itself, for competition is quite as keen on the other side of the Atlantic than here, but if consideration of the name inspires us to consider the two types of tour side by side we get some suggestions for a contest of a new type.

The Ford Tour is primarily a trial of transport planes, notwithstanding its having been won for three out of the last four years by open cockpit machines. Even they, in fact, compete primarily as light transports or mail-carriers, with no definite stipulation for passenger accommodation beyond that for the pilot and with a score proportioned to the weight that they can carry through the tour. There is no separate place and no special provision for the private-owner plane or the aerial touring machine as such, and planes designed primarily for economical service in that class have, when they have entered at all, been on the whole strikingly unsuccessful.

The International Challenge for Light Planes goes near to the other extreme. Though entries still come with the backing of manufacturers, they are made in the name of an aero club instead of a factory. No plane weighing over a thousand lb. empty is allowed to compete. The rules are designed to insure a test of the qualities of touring craft as seen by the private tourist, and the race is not to the swift, for first and second places last year went to German monoplanes of very light wing loading, high aspect ratio, and well under a hundred horsepower.

The two things cannot well be combined. They call for different routes, different schedules, and different formulas of award. If the Ford Tour is to continue in its present guise there should be no expectation of securing the participation of the light and comparatively slow sport planes. They stand equally in a need of a competitive tour, and they should be given one of their own—with a special class for genuine private owners, not connected with the aircraft industry and flying their own machines.

It may take time to assimilate the idea of such an event and to get it started, although it need not and should not take long with both National Air Tour and European experience of several years past to draw upon. In the meantime it occasions us great regret to see the entries for the International Challenge again closing with America unrepresented.

There are a number of original American types which are legally qualified to enter and which could, we believe, make a good showing. Laying the purely sporting element and the inherent interest of an international contest aside, there are concrete and practical reasons for having at least one American machine on the scene in future, even though it is now too late to do anything about 1930.

The slowing down of sales at home has fixed our attention on the export market. The sales of American airplanes abroad need not be limited to the western hemisphere. Admitting that for the present it is out of the question to invade the territories of the great aircraft-

manufacturing countries even with a purely commercial product, there remain the Scandinavian and Baltic countries. There remains also the possibility of finding licensees to build from American designs. International licensing need not be a unilateral process. The De Havilland Company has found responsible firms to take licenses under its designs in at least two leading continental countries, and our manufacturers might do quite as well. Furthermore, in course of time the private purchaser in France and Great Britain as well as in Chile and Norway is going to insist on getting the best available value for his money. In private transactions, it is only very rarely that patriotism takes lasting precedence over self-interest. If the American aeronautical industry runs its affairs with as much intelligence as has gone into the design, production, and selling of American automobiles, the way to parallel in some degree the triumphs of Ford and General Motors lies open before it. All those prospective purchasers have their eyes fixed upon the Light Plane Tour, and a success there would be of immense value not only to the individual factory concerned but to the whole American industry. If one American machine could be selected, either by a committee or through a preliminary trial on this side of the water, which would have a good chance of victory it would be worth the while of the whole industry to contribute to a fund to send that one over as a representative of what American design and workmanship have to offer.

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Fireman Save My Plane

THOSE WHO think sprinkler systems are the most efficacious enemies of hangar fires, and those who hold an opposite point of view, got together in Washington recently and deliberately set fire to the contents of a wooden hangar to see for themselves what the sprinklers would do in the way of controlling the situation. It may be summed up as a contest between the power of fire, when fed by high test gasoline and doped fabric, and the power of water as delivered via various types of sprinklers.

Experts of the Bureau of Standards and members of the Fact-Finding Committee in charge of the tests studied the aspects of every blaze with the aid of instruments—such as those indicating temperatures at the roof of the hangar, rate of flow of water, and pressure in the pipes, etc. It is too early yet to hear their decisions on the value of sprinklers in hangar fires but without having to wait for their findings, we can say that, as a result of our observations, we would prefer to park our plane in a hangar equipped with sprinklers, and if we owned a hangar we would prefer having it safeguarded by the same method.

In other words, to us it appears that the long controversy between the aviation industry and the fire underwriters as to the relative value of sprinklers in hangars has been won by the latter. To the industry's contention that water will not extinguish burning gasoline, we must agree. To the underwriters' contention that while the gasoline does continue to burn it is restricted materially from spreading to almost certain greater damage were the sprinklers missing, we concur also and assert that this is well worth knowing about and applying.

This does not by any means rule out other means of fighting hangar fires. For instance, there are many hangars so situated in relation to the available water supply that it would be impossible to install a sprinkler system. Again, though sprinklers are installed there may well be need in every fire for these other types of equipment to be brought into play, to supplement the water flow. A hangar full of planes presents an extremely potent hazard and one would be entirely justified in supplying every means, automatic and others, against the outbreak of this menace.

Leading up to this "trial by jury", the underwriters long ago presented to the industry through the latter's representative organizations, a code of hangar construction—of high order and including sprinklers—on which the insurance rates would be based. The industry was anxious for lower rates and wished to build hangars as inexpensively as it considered reasonable. The underwriters declared a minimum position on the construction methods, insisted on sprinklers and declared that rates could not drop below a certain point until its conditions had been complied with. The industry declared sprinklers were unnecessary, cost too much anyway, and in general it rebelled.

The upshot of several attempts to adjust differences was that the recent set of sample tests of hangar fires in which sprinklers—the chief bone of contention—would be used. The matter was placed in the hands of a fact-finding committee composed of representatives of all sides of the question and headed by Col. Harry H. Blee of the Aeronautics Branch. The Bureau of Standards co-operated, the tests were held on the Bureau's grounds and its experts assisted in the tabulation of data. Altogether, the final reports should be as authoritative and fair as any investigation into both sides of dispute could well be.

The question was an extremely important and delicate one to decide. Its settlement will influence construction of airport buildings to a marked degree. These buildings are assuming more and more the aspects of buildings used in other industries so, after all, why shouldn't they be subject to the same safeguards generally practiced in them. While the presence of quantities of high test gasoline complicates the situation, it has been quite strikingly demonstrated that sprinklers may be counted on for much protection.

PROBLEMS OF *Aerial Photography* IN ALASKA

By
LIEUT. R. F. WHITEHEAD, U. S. N.
Photographic Officer, Alaska Mapping Expedition

THE ALASKA Mapping Expedition which during the summer of 1929 mapped 13,000 sq miles of southeast Alaska employed four OL-8A amphibians equipped and available for mapping flights. Two planes were used for mapping, one for oblique photographs and the fourth as a standby. While these planes have not the visibility desired for mapping, otherwise they performed functions satisfastorily for this type of work.

Each mapping plane had a crew of three, pilot, navigator and photographer.

It was the pilot's duty to keep the plane at the mapping altitude of 10,900 ft, to keep it level, both laterally and longitudinally and also to keep a constant air speed

The navigator directed the pilot along the proper flight line, signalled the photographer when to start and stop taking photographs and kept a record of the time and place of starting and stopping of the runs The navigator drove the pilot much as an individual would drive a horse The navigator secured lines from his cockpit to the pilot's arms and by pulling on them directed the pilot on the proper course. Small lights were rigged in both the pilot's and navigator's cockpits in order to indicate when an exposure was being made These lights were flashed on by the photographer five seconds before the picture was being taken, and off after exposures had been completed. The average interval between exposures was 15 sec, thus giving about 10 sec in which to direct the pilot on a new course in case the plane was off the flight line

The photographer had as his duties the making of pictures when directed to do so by the navigator, keeping a record of exposures made during the run, and making exposures often enough to allow for a 70 per cent directional overlap This overlap, or rather, the interval for the overlap, was obtained by noting the area covered in the view finder, the lines in the view finder being spaced to indicate the overlap between successive exposures This interval, of course, varied according to the ground speed and the altitude of the plane above the territory being photographed In Alaska where the altitude varies from sea level on the shore lines to 8,000 ft, the exposure must be carefully watched The shortest interval used was 7 sec, and the longest 32 sec

In the December, 21, 1929 issue of AVIATION *there appeared an exceptionally interesting article dealing with the work accomplished, and the personnel and equipment of the 1929 Alaska Mapping Expedition ¶We take pleasure in publishing a second article on that most important and highly successful aerial venture Lieutenant Whitehead relates the problems encountered in the work, and places particular emphasis upon the maintenance difficulties on cameras operated in cold temperatures.*

The first base of the Alaskan Aerial Survey Detachment, City of Ketchikan, Alaska

The camera, of course, must be kept level and crabbed to allow for the angle between the course and the track of the plane

Prior to each mapping flight, the mapping team would look over the charted area to be mapped The best available charts or maps were used for flight charts—either the Coast and Geodetic Survey to the scale of 1-200,000, or the International Boundary Commission to the scale of 1-250 000 Flight lines were drawn 4½ miles apart and were possible at right angles to the shore line. Spacing of 4½ miles was to allow for lateral overlap of 30 per cent

The purpose of placing flight lines at right angles to the shore line was to take advantage of the Coast and Geodetic Survey control points As some of the flight lines extended over 30 miles with practically no land marks for reference, it required careful piloting and expert navigating to keep the plane on the proper flight line, especially so when strong cross winds were encountered.

SUCCESSFUL MAPPING can be accomplished only with the greatest co-operation between pilot, navigator and photographer Had one or the other failed to carry out his specific duties the mapping photographs would have been practically valueless

In order to take advantage of any area that was clear of clouds, each plane was given a flight schedule with at least three choices in different localities These choices were listed in order of preference and the navigator of the mapping plane could shift from one choice to another to take advantage of the most favorable weather conditions The flight schedule also directed how each plane should proceed from and return to its base This was necessary in order to have accurate knowledge where to search in case of a forced landing of any mapping plane

Two 4-lens cameras (T-2), two Fairchild K-3A cameras, four Stineman developing reels and other general photographic equipment comprised the material for the Alaska expedition The T-2 4-lens cameras were used for all mapping photographs

Following the arrival of the Gannet and the Navy barge at Ketchikan on May 24 everything was in readiness for mapping On May 24 the weather was not clear enough for mapping flights, but was clear enough to climb to the mapping altitude of 10,900 ft On that occasion the opportunity was used to test the cameras, check overlap and familiarize pilots, navigators and photographers with their duties

On the first air tests, one of the T-2 cameras proved to be satisfactory, check being made by 20 exposures taken during a two hour flight In the other two cameras the film tore after a few exposures. Examination revealed slight burrs in the rollers, which together with the film being brittle due to low temperature, probably accounted for the casualty, as they later proved to be satisfactory after rollers had been smoothed down with crocus cloth.

On May 30 the first mapping flight was made over Kuiu Island. The film tore in one of the T-2 cameras after 51 exposures No reason could be found for this other than that the film was very brittle on account of the extreme low temperature at the mapping altitude, the temperature being minus 6 deg. F In the other mapping

cameras the shutters of B and C lenses missed at intervals. The plungers of all shutters were examined and both the plungers and bushings were rubbed with crocus cloth and thoroughly cleaned. After that they functioned satisfactorily.

As mapping flights in early June indicated that the shutters were not working as satisfactorily as they should, both cameras were taken to the Petersburg Cold Storage plant where a test was made to determine the action of low temperature on the shutters and plungers. The cameras were mounted and operated as in actual mapping operations, exposures being made at regular intervals and the temperature lowered to 10 deg. F. After 40 min. at this temperature the plungers became sluggish and after an hour the shutters failed to function, or functioned only intermittently. The cameras were then taken to a warmer room and after 10 min. in a temperature of 50 deg. F. the plungers again worked satisfactorily. Then all plungers were removed and carefully rubbed with crocus cloth to give them more clearance in the brass bearings. Following this the cameras were tested again with the increased clearance and the shutters of both cameras performed perfectly for over an hour at 10 deg.

Before each mapping flight all plungers were removed from the shutters and both the plungers and bushings were thoroughly cleaned. In addition to this a brass plate was manufactured to fit over the base of the camera to keep dirt or any small particles from getting near the plungers or bushings. This plate was removed after the plane had left the water and the camera hatch opened. It was also our practice to operate the shutters about every 30 sec. from the time of take off until ready for mapping in order to prevent possible freezing of shutters while climbing to the mapping altitude. Even after all these precautions were taken, occasionally one or more of the shutters of both cameras failed to function.

Before undertaking such mapping operations, camera shutters should be tested for at least an hour at a temperature to which they will be subjected during operations. It is difficult, except between runs, to note if the shutters are functioning properly. At the present time the first knowledge of shutter failure is obtained usually only after the film has been developed, fixed, washed and placed on the drying reel where the film can be examined for misses. It would be a distinct advantage in saving film and time and expediting mapping operations if the camera had an attachment which would indicate to the photographer at once when any shutter ceased to function.

The only spares carried for the T-2 mapping cameras were one camel hair brush, one screw driver, an open end wrench, a stop watch, 2 spirit levels, and one roll of adhesive tape.

In order to determine exactly when the exposed section of the film had been wound off, a small mirror was manufactured and installed at an angle to the dial. This permitted the photographer to see from his seat the white line indicated when the exposed film was wound off. As exposures were usually made at rather short intervals and the photographer was very busy keeping the camera level and watching overlap, this dial should be located so that the photographer can note when the film is rewound without changing his position.

In order to compensate for the crab of the plane and thus scale the photographs with respect to the flight course, or to introduce crab into the photographs, the camera was rotated about its vertical axis by sliding the trunnions on the circular metal bars, but the camera hatch permitted no more than a 5 deg. crab, this on account of the camera base striking the sides of the camera hatch.

On first requisition the expedition carried 40 rolls of hyper sensitized panchromatic film, 380 ft. long and 6 in. wide, and 10 rolls of hyper-sensitized panchromatic film for the fourth chamber of the camera. This film was 105 ft. long and 6 in. wide. Later 13 large and three small rolls were supplied, of which a total of 11 rolls remained at the end of the survey. Fifteen rolls of hyper-sensitized panchromatic film 75 ft. by 9 in. were used to make oblique photographs. In addition to this 6,000 ft. of negative defender panchromatic film in rolls 200 ft. long were requisitioned and 3,000 ft. in 100 foot rolls. Two thousand feet of positive stock was also carried. This film proved satisfactory for motion pictures.

Since the T-2 mapping film was delivered in rolls 380 ft. long, special developing reels were requisitioned. Each reel holds approximately one-third of a roll or 130 ft., and the complete roll of mapping film was developed in three cuttings. This size reel was convenient to use and proved very satisfactory.

A drying reel $7\frac{1}{2}$ by 12 ft. holding 380 ft. of mapping film or 1,000 ft. of motion picture film revolved by a small electric motor was installed on the barge and proved satisfactory. An Eastman professional printer was used, using both AC or DC electric current. Due to the fluctuation of electric current supplied to the barge, a parallex reflector was substituted for a Cooper-Hewitt and this proved satisfactory under the conditions.

Considerable difficulty was experienced with static on the film. A careful record of temperatures was kept and

The four Wasp powered Loening Amphibians at San Diego Naval Air Station after the return of the expedition

Leaving the temporary base at Ketchikan for a survey flight

a careful effort made to determine the cause but with very little success.

As far as temperatures were concerned, mapping operations were carried on at various degrees, the lowest recorded was on May 30 when the temperature at 10,900 ft. altitude was minus 6 deg. F., and the highest on August 5, with a temperature of 40 deg.

From May 30 to July 11 satisfactory light for mapping was available between 8 a.m. and 4 p.m. At the latter date satisfactory light was available between 9 a.m. and 3 p.m., this being reduced on August 5 to the period between 10 a.m. and 2 p.m. After August 11 until September 8 lengthening shadows reduced the time limit for mapping to the hours of 11 a.m. to 1 p.m.

The average duration of mapping flights was from three to four hours, this depending on the distance of the territory to be mapped from the beach. On clear days between May 25 and August 5 each mapping plane made two flights, but after that time only one mapping flight per plane could be made. The average time to unload, clean the plungers, reload and install cameras was about one hour. Had additional cameras been available, time could have been saved by having the spare camera loaded and ready for installation as soon as a plane returned from its first flight. This would be a valuable saving for future undertakings in case of camera casualty, as the days available for mapping are few and far between.

One cannot estimate in terms of dollars the value of the results of the expedition. It will be years before the total worth of the results can be determined. Only one experienced in conducting topographic mapping by ground methods in such a country as southeast Alaska can appreciate the invaluable aid of the mapping pictures. Accurate topographic mapping by ground method is well night impossible, at least within the bounds of warranted cost.

Since the method of taking the pictures has been discussed, possibly some explanation of the manner of using them will be of interest. Contrary to the general belief, the finished prints are not joined together to make "mosaics," but are used in a modified plane-table method, known as the radial-line method, to determine the positions of the chosen points. Lines are drawn from the station points of two or more pictures to objects common to both, and the intersections of these lines determines the positions of the objects, just as on the plane table. The station points of the pictures are the images of points on the ground above which the airplane was flying at the instant of exposing the film. They are the control points of the B pictures from negatives that were in a horizontal position when exposed but are points displaced from the centers of negatives that were inclined to the horizon plane and when so displaced are in error by an amount depending on the amount and direction of the tilt of the plane.

The importance of maintaining a horizontal position for the B negative when the exposure is made therefore becomes apparent. It is necessary to establish the positions of the station points on the compilation sheet in order to use them for locating additional points, and this is done substantially as follows. Three or more points whose positions on the ground have been determined by one of the usual surveying methods must be identified on the first of each series of photographs. These known points serve to determine the scale of the map, the azimuth of the line of flight, and the position of the station point of the picture. This last-mentioned object is accomplished, as in the three-point method of plane-table surveying, by drawing radial lines from the station point to the images of the known points on the pictures and shifting these lines over the plotted positions of the known points on the compilation sheet till the lines pass through the plotted points.

If, furthermore, the known points are common to the first two sets of photographs they serve also to orient the second set with reference to the first by a similar application of the three-point method. Continuing this process the draftsman is able by choosing suitable points common to the overlapping sets of pictures to join all the pictures of a flight, or more accurately, to plot from the successive sets of overlapping pictures the positions of as many common points as he may need or be able to identify.

All this work is done on a sheet of tracing linen, not on the pictures themselves, and yields a series of strips representing individual flights which in turn must be assembled into the final sheet. The separate sheets are not necessarily on the same scale and when of different scales, are adjusted to one another by the known control point. This control for scale, azimuth, and geodetic position was furnished by the charts of the United States Coast and Geodetic Survey. This method of using the pictures gives the positions of stream courses, roads and similar features, but does not make it possible to draw contour lines and construct a topographic map. Other methods must be used if topography is to be represented.

Such maps are the basis upon which the information collected by geologists of the Geological Survey is correlated, and they are absolutely essential to a complete investigation of the geology and mineral resources of a region. It is as yet only estimated as to how valuable these photographs will be to the geologist in connection with his field work and office study in correlating information previously obtained, but it is believed by those who have given it consideration that their value will be great.

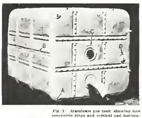


Fig 1 Aluminum gas tank showing how concentric rings and vertical and horizontal corrugations are used to take care of incidental expansion and contraction

Aluminum Welding in Aircraft Design

With the tendency toward the use of metal in aircraft construction the problem of welding aluminum and its alloys becomes one of prime importance. Considerable research has been conducted to determine the possibilities of this form of fabrication in the laboratories of the Aluminum Company of America. In the accompanying article Mr. W. M. Dunlap of the metallurgical division has treated in a general way the possibilities of welding aluminum sheet and has also touched briefly on the welding characteristics of the strong alloys. While he does not advocate welding of the alloys for highly stressed structural members, he suggests a number of possibilities in this field which have not yet been utilized.

By W. M. Dunlap
Metallurgical Division Aluminum Research Laboratories New Kensington Pa

THE METHODS of joining metals are of fundamental importance, as a structure is dependent upon the strength of the joints. Aircraft welding is the application of the general principles of welding to a particular field. A knowledge of the methods of joining metals is essential for every mechanic, draughtsman and engineer engaged in the construction and repair of aircraft.

In the early days of the industry aeronautical engineers, for the most part, were opposed to welding in the structural parts of aircraft. However, the aircraft industry is expanding with great rapidity, and old methods are being discarded and new ones adopted. The higher load factors required by the more powerful modern engines, as well as other considerations, have resulted in a trend toward the all-metal plane.

At the present time the welding of aluminum in aircraft construction ranks second in importance to that of steel. The principal application at present is the welding of gasoline and oil tanks fabricated from sheet aluminum. This is the preferred method of construction in the case of military aircraft, as well as in commercial airplanes where the maximum pay load is the goal. Welding aluminum tanks solves the difficulty of producing a gasoline-tight joint without the use of cement and fillers which are always of questionable durability. The welding of aluminum is not difficult and can be easily mastered by the aircraft welder. However, in the welding of aluminum, as well as steel, every precaution should be taken to insure a sound weld.

The fuel tanks used ten years ago were generally made of terne plate, although in a few cases brass and copper have been tried. These tanks were satisfactory, in that they were durable and easy to repair. The weight, however, of a fuel tank made of these metals was a disadvantage. The logical method of reducing the weight was to change to a material with a lower specific gravity. Aluminum sheet comes in this class. A comparison of the weight per gallon of gasoline capacity indicates that that of the welded aluminum tank is only a little more than 50 per cent of that of similar tanks made from the other commercial sheet metals. It is possible to carry between 2½ and 3 gal. of gasoline per pound of aluminum tank. Gasoline, oil and water tanks for the aeronautical power plant, due to their involved shape, must be strong and light, and contain baffle plates to prevent surging of the liquid.

A fuel tank should be designed to withstand an internal air pressure, without buckling or injury, of not less than 3.5 lb. per sq.in. Large flat surfaces in the shell of the tank should be avoided unless they are well stayed by baffles and stiffened by corrugations. The stiffness of aluminum is less than that of steel or brass; therefore the thickness of the aluminum sheet should be greater. In the average type of tank, a thickness of 0.051 in. is usually satisfactory for tanks up to about 500-gal. capacity. Cylindrical tanks may be constructed with few reinforcements except in the heads, which should be dished, crowned or corrugated. A cylindrical shape, however, is generally not economical of space in the airplane, hence, tanks with a square or rectangular cross-section are more common. The flat sides of the tank must be reinforced by stiffening with corrugations and by the use of baffles. Fig. 1 illustrates the use of concentric rings and vertical and horizontal corrugations. These corrugations also assist in allowing for the thermal expansion and contraction resulting from the heat of welding and thus prevent distortion and warping of the shell. The welding heat is applied only to the area at the seam. The result is that this area expands and, unless this movement has been allowed for in the design, a wrinkle may form. When cooling, the reverse action takes place, but the wrinkle will not pull out. The result is that a heavy strain is placed on the welded seam. The welder cannot prevent the expansion and contraction of the metal. The designer must take care of this.

Baffles which are used not only to reinforce the tank, but also to prevent swashing or surging of the liquid, contain a large number of lightening holes, and openings at the bottom to permit complete drainage of the tank. Baffles are riveted to the shell of the tank and the tops of the rivet heads are welded over to make them gasoline tight. Fig. 2 shows the welded rivet heads. The rivets should not be too large as that would cause difficulty in welding the heads. A ⅛-in. rivet is large enough for sheet up to 0.051 in. in thickness. The welding of the rivet heads should be done with care, as the building up of too much material on top of the rivet head will make a lump which causes stresses in the sheet at the edge of the weld and is apt to start a crack. The corners of the tank should be rounded as much as practicable.

THE FASTENINGS of fittings such as filler necks, gasoline gauge fittings, and sump fittings introduce complications in the fabrication of tanks. These fittings should be manufactured of aluminum tube or aluminum alloy castings in order to reduce weight. Aluminum fittings can and should be welded to the shell of the tank, but, to prevent warping, a bead should be placed concentrically with the fittings, or the fitting should be attached to an offset or embossment in the tank, Fig. 2. The tubing used for the fitting should be of the same chemical composition as the sheet from which the tank is formed. Such tubing may be welded to the sheet very easily. The castings contain principally copper and silicon as the alloying constituents and may vary widely in composition. The aluminum-silicon alloy castings are preferable for welding, even though the aluminum-copper alloy castings may have somewhat better machining qualities. Care must be exercised when welding heavy castings to the shell of a tank. The wall of the tank must be embossed or corrugated to take care of the expansion of the sheet. If this is not done, the welding heat will buckle the sheet upward at the edge of the casting. When the metal cools this buckle will not flatten out. Therefore, strains are set up in the weld, which, added to the strains of vibration, may cause cracks to develop in service.

Another feature to be avoided in the construction of tanks is the attachment of two castings so close together that the welded seams interlock. The fault indicated above can be corrected by separating the castings a sufficient distance so that each one can be encircled with a depression in the sheet, or can be mounted on a separate

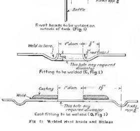


Fig. 2: Welded rivet heads and fittings

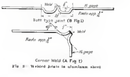


Fig. 3: Welded joints in aluminum sheet

piece of sheet aluminum and this welded to an embossment on the shell

Several types of joints in welded sheet are shown in Fig 3 These joints, if properly welded, will give strengths equivalent to the strength of the aluminum in the annealed condition This holds true no matter what temper of aluminum sheet is welded or how much excess metal is deposited in the head, as the area immediately adjacent to the welded seam will be annealed or at least partially annealed by the heat of the torch during the process of welding

Tanks must be thoroughly cleaned after welding to remove all traces of the welding flux Generally speaking, the oxide coating on aluminum is beneficial in that this very tenacious highly refractory and chemically resistant film tends to protect the metal beneath from the action of the atmospheric elements However this oxide must be removed from the welding zone if a satisfactory joint is to be obtained A flux that will adequately remove the oxide film, will attack the metal beneath Aluminum differs from most other metals in this respect Most metallic oxides adhere rather loosely to the base metal, having a tendency to scale off Furthermore, the oxides are attacked more readily by certain chemical reagents than the metal itself When iron or steel is pickled in an acid bath to remove the rust, the oxide coating is completely removed without the metal being attacked to any appreciable extent

If any trace of the flux is permitted to remain on the welded article for any appreciable length of time, the aluminum will be corroded A very efficient means of cleaning the flux from welded aluminum tanks is to wash in hot water to remove the bulk of the flux, then immerse in a hot 10 per cent sulphuric acid solution for a short period of time and rinse thoroughly in hot water

After washing, the welded tanks should be tested for leaks This may be done by connecting an air hose and completely submerging the tank in water, forcing in air and looking for leaks, which would be indicated by bubbles of air rising to the surface of the water. In case the tanks are so large and unwieldly as to make submerging impracticable the joints may be painted with soap suds and examined carefully for bubbles when the internal pressure is sufficient The tanks should be tested at an internal air pressure of from 3.5 to 6.0 lb per sq in, or more, depending upon the size shape and design of the tank A mercury column is usually used for indicating the pressure as mechanical pressure gauges are not sufficiently accurate at these low pressures

Welded tanks should preferably be supported in cradles or slings rather than rigidly attached to the aircraft structure Metal strips with a protective lining between the strip and the tank make good supporting members The lining may consist of a strip of annealed pure aluminum, or a strip of felt, impregnated with paraffine oil, or asphaltic-base paint Rawhide or composition material containing free alkalies or chlorides should never be used as there is danger of the tank being corroded by these materials Welded aluminum tanks for use in seaplanes and other aircraft operating near salt water should be well protected on the outside by painting with aluminum paint A finish coat of enamel may be applied over the aluminum paint if desired.

There are many places other than tanks where it might be of advantage to substitute welding for riveting. For example, fairings, wing pontoon stiffeners, cowling, pilot seats, furniture and other parts that do not go to form highly stressed structural members, and where a reduction of strength in the vicinity of the seam is not objectionable, may be torch welded There are also places where electric resistance spot welding could be used to advantage Ammunition carriers on pursuit or fighting planes could be spot welded It is probable that in the near future wing parts such as ailerons, beams and struts will be so designed as to permit their being assembled by spot welding The baffle plates for gasoline

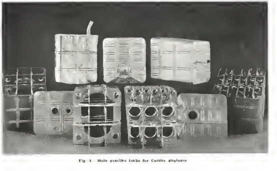


Fig 4 Main gasoline tanks for Curtiss airplanes

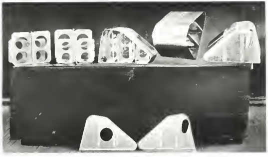
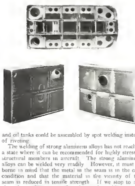


Fig 6 (above) Ballast tanks fabricated from aluminum Fig 5 (below) Wing tanks fabricated from aluminum.



and oil tanks could be assembled by spot welding instead of riveting

The welding of strong aluminum alloys has not reached a state where it can be recommended for highly stressed structural members in aircraft The strong aluminum alloys can be welded very readily However, it must be borne in mind that the metal in the seam is in the cast condition and that the material in the vicinity of the seam is reduced in tensile strength If we stop to analyze the conditions prevailing during the welding operation, we will find that the following is probably true The metal in the seam proper has melted and resolidified, hence is in the cast condition The metal immediately adjacent to the cast area has been raised to the heat treating temperature by the heat of the torch flame, and has received an air quench The area adjacent to this has been raised to the annealing temperature and is softened to some extent The next area has received an artificial ageing by the heat of the torch A portion of this area is, in all probability over aged Beyond this area, the sheet has not been affected by the heat of welding The total area of the sheet affected by the heat of welding will probably extend from one to two inches beyond the welded seam on either side If the structure is heat treated subsequent to welding, the affected areas in the wrought metal will disappear However, duralumin in the cast condition, even when heat treated, does not develop the high mechanical properties of the wrought material, hence the strength and ductility of the cast metal in the seam will remain low. Duralumin as welded has a tensile strength of from 38.000 to 40,000 lb per sq in, and an elongation of about 4.00 per cent in two inches By hammering after welding, the strength may be raised to 46.000 to 47.000 lb per sq in and the elongation to 6.00 or 7.00 per cent By hammering and heat treating after welding, the strength may be raised to 50.000 lb per sq in or more and the elongation raised to 8.00 or 9.00 per cent However, hammering and heat treating a welded structure is not always practical In order to obtain good corrosion resistance the material should be water quenched as it comes from the furnace. This would induce warping and buckling in the welded structure

Accurately controlled electric heat treating furnaces of dimensions sufficient to handle welded aircraft structures are being built at the present time It is not beyond the realm of practical possibility that, in the not distant future, light aluminum aircraft structures will be assembled by welding, clamped in rigid jigs, heat treated and water quenched The writer can visualize methods that the engineer of yesterday would have considered extremely radical, but which the engineer of tomorrow will accept as standard practice for assembling light aluminum aircraft structures.

THE *N.A.C.A.* MEETS THE *Industry*

Technical Progress Reviewed and Problems Presented at Fifth Langley Field Conference

By LESLIE E. NEVILLE
Technical Editor of AVIATION

Visitors and guests of the Fifth Annual Aircraft Engineering Research Conference

ANOTHER milestone in the progress of the National Advisory Committee for Aeronautics has been passed in the form of the Fifth Annual Aircraft Engineering Research Conference held May 13 at Langley Field, Va , and once more the viewpoints of the commercial and research engineers have been compared

From the standpoint of the commercial engineer it would be a mistake to say that there was any one outstanding feature of the conference It is probable that each visitor had a different opinion as regards the most important work of the N.A.C.A However many of the pertinent problems of the aeronautical engineer are nearer their solution than they were a year ago

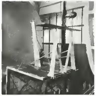
Probably the underlying theme of the research work of the N A C A is a tendency toward full scale and full flight measurements The laboratories are constructing larger wind tunnels, the variable density tunnel is beginning to show its value and the flight test section is developing new and improved instruments to measure the characteristics of an airplane subjected to various maneuvers under true flight conditions

As usual the arrangements of the N A C A to make the trip comfortable and instructive were carefully planned and the entire schedule was followed strictly without deviation The more spectacular part of the program was repeated the following day for the benefit of the service men stationed at Langley Field This was made necessary because of the somewhat restricted capacity of the laboratories and the officers' club where the speaking sessions were held As the service men were most interested in the inspection of the laboratories it was thought desirable to provide this feature for them exclusively on a separate day The industry was well represented as a result of the care exercised by the committee in extending invitations to prospective visitors

As in the case of former conferences, there were three general divisions in the session The morning period at which Dr Joseph S Ames presided in his usual incomparable manner, was devoted to a brief resume of the year's work by the heads of the subcommittees engaged in various research programs Following this the visitors were divided into four groups for inspection of the various laboratories where spectacular experiments were set up to illustrate the work

The third period, in the afternoon, was provided to permit visiting engineers to present their general problems and offer suggestions as to the future work of the laboratories

Space limitation prevents a verbatim report of the conference at this time but the complete minutes will be distributed by the N A C A in the near future In the interim we will attempt to outline briefly the ground covered at the three sessions All of the information discussed at the morning session, as well as the facts reflected by experiments shown during the inspection tour, have been published recently or is scheduled for early publication in the form of the familiar Reports, Memoranda and Notes of the Committee



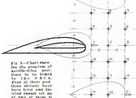


Fig 1—Chart showing the program of nacelle-wing positions to be tested by the N A C A. Four of these positions already have been tried and the wind tunnel set up of two of them is shown on the opposite page

THE MORNING SESSION was opened by Dr Ames and conducted by Henry Reid, engineer in charge of the Langley Memorial Aeronautical Laboratory

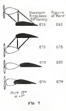
Dr Ames spoke briefly of the Committee's work and purpose, and eulogized the late Capt L M Woolson who had presented the Packard Diesel engine on its first cross-country test flight at the previous conference Dr Ames also told the assembled visitors of the new wind tunnel and water channel, both of which are in the course of construction on the laboratory property The new wind tunnel will be rectangular in shape, having a 30-ft by 60-ft throat, and will have two propeller fans driven by a 6,000-hp engine which is expected to provide a stream velocity of 100 to 120 m p h The water channel is to be more than 2,000 ft long, 25 ft wide, and 12 ft deep It is expected that models will be propelled through it at a maximum speed of 60 m p h

After an address of welcome by Commandant Weust of Langley Field, the first speaker was Mr Elton W Miller, chief of the aerodynamic branch, which is one of the two subdivisions of the laboratory

Mr Miller outlined concisely several of the more important problems of the aerodynamic section One of these is the program devised to investigate the effect of engine nacelle position on the lift and drag of an

airplane wing A program has been proposed, as shown in Fig 1, and at the present time four of the suggested positions (Figures 2, 3) have been completely tested In all of these tests, conducted in the 20-ft propeller research tunnel, a model wing of 12 ft span and 30 in chord has been employed, and the propeller used in the model has been made to operate by means of an electric motor within the nacelle Tests have been made to show the effect of a stopped propeller and a propeller that is freely rotated but not power driven Results so far indicate that the engine nacelle located below the wing gives less drag than that placed above and that there is a decided advantage in locating the nacelle in the leading edge of the wing The program is to be continued for all the proposed positions indicated in the chart

Another vitally important problem discussed by Mr Miller was the investigation of the interference drag of the component parts of an airplane structure Tests were made in the variable density tunnel on a model closely resembling the Lockheed airplane and so constructed that the wing could be shifted to high, low or intermediate positions, the landing gear attached or removed, and fillets of various sizes interposed at the junction of wing and fuselage in all cases From the standpoint of decreased drag the high wing monoplane definitely has the advantage and an advantage at high lift was found in using the largest of the fillets The landing gear drag is shown to be a highly important item in the total drag of the airplane and changes as the location of the wing surfaces is changed



Pitch 17°
α = 0°

Fig 2

Another investigation reported by Mr Miller is that of determining the aerodynamic loads on the wing structure and tail surfaces of various airplanes Considering the fact that in high speed flight there is a deflection in the wings resulting in a change of angle of attack near the tips, the effect is to change the character of the loading As such deflection is likely to cause wing flutter it was desirable that it be measured in order to provide proper structural design to prevent the imposition of dangerous stresses It has been found that variation in the wing tip form is an important consideration and although the program scarcely has been started a number of tests have been made on two forms

Mr Miller also told of an experiment to determine the drag of the separate parts of a Fairchild cabin monoplane The results of this experiment are set forth in Fig 4 and it is of interest to note that opening the windows increased the drag 1 7 per cent, and that the drag of low pressure air wheels was found to be approximately the same as that of standard wheels and tires The engine drag was higher without the wing and the tail drag lower without the wing Work has begun on the water pressure distribution tests on an H-16 hull and two landing stages already have been tried

Following Mr Miller, Mr Fred Weick told of a number of tests made in the propeller research tunnel on various propellers with five different fuselages As a result of these tests Mr. Weick has developed a series of curves and a simple mathematical formula which can be used by an airplane or propeller designer to select a propeller of the desired characteristics for any given combination of fuselage and power plant that so far has been included in the investigation

Mr. J W Crowley of the flight test section of the laboratory explained in some detail the progress of the study of the spinning characteristics of various airplanes and presented a chart, Table I, showing the factors affecting the spin One significant discovery so far is the rolling moment due to sideslip is equal in importance to the rolling moment due to roll (autorotation)

Maximum difference 4%
pitch 17°

Fig. 3

Mr. William McAvoy, senior test pilot of the N A C A, next told of the flight test work in cowling research Three types of fuselage have been used No 1, the Curtiss Sea Hawk with a Pratt & Whitney Wasp, No 2, a rounded fuselage with uniform section, and No 3, a modification of No 2 but of slightly smaller section Tests have been made on various types of cowling and it has been found that the type having no inner cowling was as effective as the original type but gave slightly higher temperatures The angle of cowling to thrust line was also tested through a 14-deg range

Reporting on behalf of the power plant section Mr Carlton Kemper, chief of this division told of the work on compression-ignition engines air-cooled two-stroke-cycle engines using gasoline ignition, and the comparison of the exhaust turbo and Roots type superchargers Work has progressed to the stage where it is possible to predict the characteristics of a given design of fuel injection system A number of orifice diameters have been tested and study has been made on the effect of orifice length-diameter ratio on spray-tip penetration Some interesting results have been obtained through a study of motion of the valve stem A comparison of the integral and pre-combustion types of cylinder heads is under way and has yielded some interesting results so far in the form of increased brake mean effective pressure Mr Kemper explained that, while the work on the exhaust turbo supercharger was largely negative it provided a basis of comparison with the more essentially commercial types

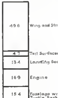


Fig 4

During the period devoted to inspection of the laboratories the experiments set up were for the

most part spectacular but served to give a general idea of the work being accomplished in the various sections In the building housing the variable density tunnel Messrs Eastman N Jacobs and John Stack gave demonstrations of the variable density and high speed vertical tunnels, speaking briefly of the interesting work that had just begun The demonstration began with a run of

TABLE I

Factors Affecting Spin

I. Aerodynamic forces and couples
  1 Rolling moment due to rolling
    A Geometric proportions of airplane
      I Airfoil sections slots etc
      II Washout, sweepback, etc.
      III. Biplane combinations
      IV I, II and III with controls deflected
  2 Rolling moment due to sideslip
    A
      I, II, III, IV } Same as above
  3 36 factors similar to above

II Inertia forces and couples
  1 Moments of inertia
    A Inertia couples
  2 Precessional moment due to prop
  3 Wing loading
  4 Position of C G

N Y 1 Spins	Service	Altered	
Weight	2,390	2 900	lb
C G	25 8	41 2	per cent m.a.c
I_x	2 380	2 326	sl—ft ^{2}
I_z	3 887	4 941	sl—ft ^{2}
Radius	4 5	9 3	ft
1 Turn	2 5	3 5	sec
Vert vel	79	95	ft./sec.
Recovery	1	1	turn
Attack	49	48	deg
Side slip	1	1	deg
	2.4 sec for complete turn	3 3 for same	

the variable density tunnel In the vertical tunnel a propeller tip was tested in an air stream having such a high velocity that the moisture from the atmosphere condensed and the actual air flow was visible making it possible to note the pronounced vortex at the propeller tip

The old atmospheric tunnel has been replaced by three other wind tunnels of various types under the direction of Mr Montgomery Knight One of the new tunnels is a 5 ft vertical type especially for the study of spinning characteristics in various types of wing cellules A spectacular experiment was set up in this tunnel using a model fitted with wing tip floating ailerons Provision was made to release the ailerons on the model and it was noted that ailerons of this type prevented autorotation of a wing which under normal conditions was subject to serious autorotative characteristics

The refrigerated wind tunnel shown last year by Mr Knight was in full operation to demonstrate the action of the new Geer rubber shoe in the prevention of ice formation The rubber shoe fits tightly over the leading edge of the wing and is impregnated with a combination of pine oil and other ingredients to reduce the adhesion of ice to the rubber so that ice formations over the shoe will break away if disturbed by some mechanical means A small quantity of air pumped into the shoe expands the rubber just above and below the leading edge, causing the ice to fracture and blow away This was demonstrated in the refrigerated tunnel A small convertible model was tested for drag with the engine improperly properly and ideally streamlined and the results shown in a striking manner while the effect of the landing gear on the total drag of the structure also was demonstrated An historical exhibit showing the evolution of the latest type of recording and integrating multiple manometer was explained by Mr Knight

In the flight test section the familiar pressure distribution measuring apparatus was shown together with a number of flight instruments developed at the laboratories The most recent of these is the new angle of attack recorded which is designed in accord with the general principles used in other N A C A instruments Two types of suspensions were shown for use in determining the moments of inertia of a complete airplane Some of the apparatus used in the cowling tests was also shown including a cowling having fins upon which a mixture of lampblack and kerosene is coated to indicate the actual air flow around the outer surface of the cowling Among the cowling test devices was the variable angle cowling used to determine effects of changes in angle between cowling and thrust line, and one cowling containing an integral exhaust manifold All of the devices used in the flight measurement of spins were shown and demonstrated In the propeller research tunnel building Mr Donald Wood gave a brief demonstration of the method used in conducting the nacelle position test Visitors also were shown the Nichols airfoil cutting machine which is used in the production of metal models for wind tunnel work

The power plant laboratory exhibit made it possible for the visitors to visualize the method used in the experiments outlined earlier in the day by Mr Kemper Included in these exhibits was the apparatus for recording stem motion of injection valves, the set up for experiments on the two-stroke-cycle air-cooled, gasoline injection engine and a demonstration showing the effect of supercharging on the increase in power of an engine having a low compression ratio without increasing the maximum cylinder pressure

The afternoon session was opened at 2 20 p m by Dr Ames who invited the visitors to present their problems in the form of brief talks As there were no voluntary speakers Dr Ames called upon various persons he had seen during the morning session in order to start the discussion The first visitor called upon was Mr R W A Brewer, who requested information on the effect of pusher propeller installations and on the location from the viewpoint of thrust and interference He also was interested in the result of bleeding air through airfoils and the problem of propeller and exhaust noise Mr Reid responded that the pusher type propeller is already included in the future program and that the laboratory is planning to attack the sound reduction problem

The second speaker was Mr F W Caldwell, who suggested a study of new propeller forms in high speed work and of the torsional properties of propeller sections Mr Weick responded that some work was to be done in this direction, after which Dr L J Briggs stated that the Bureau of Standards had conducted some experiments covering the problem on a small scale In explaining the results he stated that propellers having the

ordinary sections such as the Clark Y and R A F -6, fall off in efficiency beyond one-half of the speed of sound, the thinner sections falling off later and the thicker sections earlier than this point A species of burbling phenomenon has been observed over small airfoil sections at high speed He further stated that the maximum ordinate had been moved to the center in tests and it was discovered that above 95 per cent of the speed of sound the section thus produced proved more efficient than either the Clark Y or R A.F , and at 1 8 times the speed of sound it was found to be 15 per cent more efficient

Mr R. Chilton suggested that since the floating aileron has been shown to cure autorotation, a careful study of the characteristics of a complete airplane in the stalled attitude should be made in order to obtain the full advantages of the stall He further stated that the Wright company had been working on supercharging and learned that a large temperature rise limited their work on the ground He requested a curve plotting highest useable compression ratio against inlet valve temperature for a standard fuel Mr Henry M Crane of the Bureau of Standards replied that this would be a difficult problem and that, while the Bureau of Standards could predict the general form of such a curve no absolute figures were in possession at the moment He suggested a collaboration of the Bureau of Standards and N A C A to obtain this information Mr Chilton retorted that information regarding the inlet temperature and the location and intensity of hot spots would probably be as helpful in his work Dr H C Dickinson of the Bureau of Standards told of its work on rate of flame propagation and mentioned that twelve factors have been found to enter into the problem of detonation, the most recent of these being humidity of charge

MAJOR R H FLEET next spoke, congratulating the N A C A on its work and stated that he had two important problems, the nature of which he would not divulge

Charles Ward Hall stated that the progress in cowling experiments had by far exceeded his expectations and that he had two additional resistance problems, one a study of cabin fuselage shapes, and the other a method of eliminating burbling over the back of the fuselage and turbulence over the pilot's cockpit in case of open planes He also asked further investigation of the effects of placing an engine in the position it normally occupies in a flying boat

Dr Charles G Abbot of the Smithsonian Institute suggested study of the problem of jet propulsion and Mr Eastman N Jacobs, director of variable density wind tunnel, stated that such propulsion had possibilities for very high speed craft He continued, saying that a large amount of kinetic energy was carried off by the jet and that it would be necessary to increase the momentum of the jet, which had been accomplished to a slight extent Dr H L Dryden suggested that the Bureau of Standards co-operate with the N A C A in studying methods of increasing effective thrust of jets

A desire to obtain additional information on the results of airship deceleration tests, including those of the recently completed foreign ships was expressed by Dr K Arnstein and Mr C. B. Fritche Dr Wolfgang Klemperer requested that an instrument be developed to read the torque of an engine at a point on the shaft between engine and propeller without cutting the shaft Mr Reid responded that work was in progress on a hub dynamometer, but that no work had been planned for long shafts Mr A E Larsen told of the progress in the development of the autogiro and stated that its problems were of such an individual nature that he was not yet in a position to submit them to the N A C A

Mr C N Monteith reminded his hearers that the designer controls but 35 per cent of the weight of an airplane and said that he would recommend the elimination of any of the component parts He requested practical information on the relationship of rudder and fin area to dihedral angle, and Mr. Crowley stated that in the flight test work of the N A C.A fin area had been reduced to a relatively low point, but that the results had not yet been observed Professor Alexander Klemin suggested a resort to the classical theory to solve this problem, and Mr B V Korvin-Kroukovsky stated that his empirical method had been found consistent in a number of problems and that the calculations involved required only about one hour [The reader is referred to an article on Proportioning the Airplane for Lateral Stability by Mr Korvin-Kroukovsky in the Aeronautical Engineering Section of AVIATION January 19 1929—Ed]

Mr L C Milburn commended the Committee upon its construction of the new model basin and Mr W H Miller suggested that the flight test work be supplemented by a theoretical study of pressure distribution

ONE OF the outstanding talks of the afternoon was that by William B Stout in which he commended the Committee for its frankness in presentation of facts without bias and pointed out the advantage of obtaining negative, as well as positive results in research Mr Stout agreed with Mr Monteith that some of the parts of the present-day airplane would have to be eliminated in the future and suggested the possibility of reducing drag by elimination of landing gears

Mr Grover Loening disagreed with Messrs Monteith and Stout, saying that airplanes could not be simplified and made attractive to the individual citing as an example the addition of brakes and starters He suggested research on silencers and variable pitch propellers as well as the shape and disposition of front windows of cabin planes. He suggested less static work and more flight testing and commended the N A C A for its use of lampblack and kerosene to determine the air flow over a fin used in one of the cowling studies He suggested that this method be used to determine the effect of slipstream on rudder and fin

Mr C T Porter asked that the nacelle relation tests be extended to the biplane cellule and that some attempt be made to determine the relation of propeller diameter to nacelle diameter He stated that the increase in performance obtained by use of a geared engine was frequently greater than anticipated, which is probably due to this relationship He also suggested an investigation of the aerodynamics and cooling properties of tandem engine installations

The sound problem was summed up aptly by Mr. W B Mayo, who said "Noise is the product of inefficiency" He suggested study of propeller noise, possible changes in propeller sections and elimination of exhaust noises insofar as possible He also stated that he was interested in large airplanes having multiple engines fuselage form, and the relation of nacelles to tapered wing In his talk he pointed out that planes were limited in size mainly by engine sizes

Following the afternoon session visitors were free to inspect in detail, any of the experiments or apparatus in which they were particularly interested

THE SECOND NATIONAL

Airport Conference

A Review of the Committee Reports Read During Three Day Meeting of the Aeronautical Chamber of Commerce

By CHARLES H. GALE
Assistant Editor of AVIATION

DURING the twelve months elapsed since the first national airport conference at Cleveland in May 1929, the attention of the airport interests has swung from the constructional aspect of the airport to operation and problems of refining the equipment already installed It was on such matters that the airport and airport equipment men concentrated during the second national port conference held at the Hotel Statler, Buffalo, on May 14-16, last week, under the auspices of the Airport Section, Aeronautical Chamber of Commerce of America

The sessions of this annual "clearing house" for airport problems indicated that plenty of perplexities exist but apparently they are chiefly those coincident with growth and progress rather than with hard times Whatever the rest of this industry may be experiencing, it appears that for the most part the business of bringing the airport facilities of the country to a high degree of usefulness is marching steadily onward

A feature this year was the provision of ten committees, to each of which was assigned one of the outstanding airport problems for consideration Each member of the conference attended at least one of these committee meetings and theoretically participated in the preparation of the group's report to the conference as a whole The committee meetings occupied most of the first day of the conference and the reports most of the second day Thus method made possible covering many subjects quite intimately, an accomplishment otherwise impossible without several more days being added to the program.

Another feature was the display of exhibits of fourteen manufacturers and the Aeronautical Chamber, in space adjoining the conference room and the exhibition of airport equipment staged at the Buffalo Municipal Airport on the last afternoon and evening of the program

While the attendance was a little disappointing in the light of the position of the conference as the main airport council of war of the year, there was nevertheless an excellent representation from all parts of the country and Canada, with 159 individuals actually registering It is interesting to note that 39 of these represented established airports or airport commissions while the balance represented manufacturers of equipment or specialists in service to the airport, publications, etc

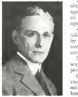
Victor Vernon, vice-president of Curtiss-Wright Airports Corp., who presided at Friday morning session

ASIDE FROM the items emphasized in the committee meetings and the reports of these committees —discussed in the following—the questions which seem to be causing the principal concern today are the ways and means of handling aviation fuel and lubricants and the desirable policy to be adopted with respect to local handling charges and state taxes for the same Comments made in several sessions displayed a wide diversity of opinion, there being strong adherents to both sides of the question whether or not there should be a state tax devoted to the improvement of airways within the state, whether or not there should be a levy by the individual airport on the fuel handled by a transport company exclusively for its own planes, etc

No action was taken by the conference in respect to these problems except to vote that it be referred to the executive committee of the Airport Section of the Chamber for further investigation While on the subject of fuel, it should be mentioned that at the luncheon meeting Thursday, May 15, Maj E F Aldvin, of the

Standard Oil Co of N J, read the resolution of the Advertising, Sales and Ethics Committee of the Fuel and Lubricants Section of the Chamber to the effect that its members, which includes about all the principle oil companies, shall not give airports free gasoline and oil, or pay money, grant special discounts or furnish free advertising for exclusive rights at an airport or make any donation of prizes, money or products in connection with a flying project, or carry direct newspaper or display advertising for the benefit of airport operators. This group also accepts the code of marketing practices adopted by the American Petroleum Institute

This action is extremely important since it will eliminate many undesirable competition practices and abuses of the "free" or discount concessions often made to airports



Col C. O Sherrill Cincinnati who asked for standard code for municipal airports

AMONG the unscheduled but very valuable by-products of the conference were the informal meetings of the airport managers Out of their several sub conferences came a number of decisions These were

1 That the Airport Section of the Chamber be subdivided to five groups to include Managers, Public Officials, Owners and Operators Manufacturers, and Airport Engineers

2 That ports adhering to the Chamber be identified as such by an insignia, this to be displayed on the field

3 That two committees be appointed one to include airport and air transport men for the discussion of port charges and discounts and the other to be a special group for the study of fire and safety measures

THE CONFERENCE got under way officially at the luncheon at the Hotel Statler, Wednesday noon, May 14 The keynote address, prepared by Julien S Eysmans vice-president of the Pennsylvania Railroad and read by his representative, emphasized the tremendous importance of providing adequate terminal facilities for aircraft engaged in the business of transportation Such facilities in the railroad world are engaging the attention of some of its best minds and airports merit the same consideration In launching the Transcontinental Air Transport line he said, five sixths of the outlay went into ground facilities

The rest of the day was given over to the holding of committee meetings in which the salient aspects of airport development and operation were discussed under the leadership of a recognized authority in the field Each committee drew up certain recommendations or resolutions which were embodied in reports read to the conference assembled in full the following day both morning and afternoon

THE FIRST of the committees to make reports on their individual meetings held on the first afternoon of the conference, presented their briefs at the morning session on Thursday May 15

T R Newell, chief engineer of the Cleveland Municipal Airport, led off with a report from his committee on surfacing and drainage problems, the two problems over which many an airport operator is tearing his hair The report made the following important points

1 There should be no such thing as seasonal availability of the surface of an airport. It should be suitable for use under all conditions and at all times of the year

2 The basic load and smoothness requirements for landing areas are the same, no matter what the type of surface may be

3 Subsoil condition is vital and the big point in obtaining proper subsoil is provision of adequate drainage A thorough study of the drainage conditions by an expert should be carried out before any sound drainage project may be launched

4 Grading is another fundamental consideration, taking into consideration the maximum grades allowed by the Aeronautics Branch, and the influences of large average rainfall and the possible installation of hard surfaces

5 Grades of 1.0 per cent are preferable. With runways or paved areas, a grade of 0.2 per cent to 0.4 per cent provides ample run-off.

6. The basic principles in drainage are: (a) Provision of sufficient outlet (b) As few mains and submains as possible on account of expense (c) Long laterals are usually preferable to shorter ones, where the grade permits their use, because of saving in installation of more expensive mains (d) Open ditches are to be avoided

7 The herringbone system of main with parallel laterals or the gridiron system of a series of long parallel laterals discharging into a receiving main from one side only were recommended as best for airport work

8 Spacing of drain lines as follows was recommended

Soil	Level land	0.4 per cent-0.7 per cent grade
Dense	16 ft. apart	20 ft apart
Medium	24 ft	28 ft.
Open	36 ft	38 ft.

E. A JOHNSON, president of Dayton Airport was the next on the stand He reported the recommendation of his committee, which had taken up the matter of standard accounting systems for airports Some time ago Frank J. Walsh, assistant treasurer of the Aeronautical Chamber of Commerce and J W Ellenberger, president of Universal Accounting Systems, of Washington, were asked by the Chamber to compile a chart of accounts and an explanation of them together with a sample personnel organization chart, for the consideration of the committee and the conference

Submission of the chart of accounts and the organization chart formed the basis of Mr. Johnson's report Both charts are to be available to the operators through the Chamber. It is not necessary to comment on the individual items in the chart of accounts but the point should be made that this matter of airport accounting is an extremely important one which is receiving expert and exhaustive study In the coming months the above men will continue their survey and prepare sample record forms and other accounting papers for the complete coverage of all phases of the financial transactions of an airport

SOME INTERESTING POINTS were brought out by Maj John Berry, manager of the Cleveland airport, in his report on the recommendations and comments of the lighting committee They were in brief

1 All airport lighting now is in an embryonic stage It is largely accidental in nature, that is, it is based on methods that happen to work but are not necessarily the most desirable

2 The public must have confidence in port night lighting as it does for highways, industrial operations, etc

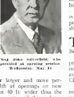
3 Football fields usually are lighted by systems carrying approximately 48 kw of lighting load as compared with the average of less than 15 kw for airports, which are many times larger in area Our airports are not bright enough

4 Perimeter boundary marking rapidly is being made obsolete through general tendency in runway markings Major Berry expressed the personal opinion that obstructions about an airport should be floodlighted and that the landing plane should depend solely upon its wing lights to pick up the ground.

5 Incandescent type of floodlight has advantages over arc lamps in ease and economy of operation but because of difficulty in controlling glare and because of lack of "punch" to the lamp, as compared with the arc, its development has lagged

6 It was recommended that lighting manufacturers and representatives of the industry in committee sessions through the year study lighting problems with the view to close co-operation with the Aeronautics Branch

In the discussion following the report it was brought out that the General Electric and Westinghouse companies are co-operating with the Airways Division of the Department of Commerce in the development of a beacon which may be installed on high tension lines on or near the airways The General Electric type is to be operated by induction and the Westinghouse by capacitor couplings Experimental installations are expected about July



Maj John Satterfield who presided at opening session Wednesday May 14

THE REPORT of the hangar construction committee was read by Capt Ralph H Higgins, chief engineer of National Air Transport The main points

1 The general trend is for larger and more permanent hangars Average width of openings on new hangars is about 120 ft—about 40 ft wider than the average two years ago It is a question if this is large enough, however The committee recommended a minimum width of 100 ft, depth of 100 ft and clearance of 20 ft at first class airports

2 A careful study should be made of the fire hazard and it was recommended that a committee be appointed to function continuously through the year for the purpose of gathering information on airport fires and co-operating with the National Board of Fire Underwriters in setting up standards for airport fire protection

3 Day lighting of hangar interiors should be studied

4 Heating remains another big problem A minimum temperature of 50 deg was recommended It was emphasized that insulation of all openings should be attended to carefully An exhaustive study of doors was recommended

5 The size of hangars depends considerably on the location of the building When the doors face the landing area an economical depth is about 120 ft When the door is at right angles to the field, the depth may be 240 ft When planes may taxi to both the side facing the field and the side away from the field the depth may be 120 ft and the length as long as desired

6 The most satisfactory floor is of concrete designed for the load to be carried, with a 1 in steel trowelled monolithic top, with proper drainage and expansion joint

In a discussion of sprinkler systems following the reading of the report it was brought out that the insurance rate at Newark Metropolitan Airport had been lowered from $4.45 per $100 to $0.23 per $100 with the installation of sprinklers

CONCESSIONS, one of the promising sources of airport income, occupied the attention of a group under the chairmanship of W Sanger Green manager of the Central Airport Camden, N J His report stated that the group represented the following opinions

1 That municipal airports need to be careful about maintaining a dignified basis of operations, as far as concessions were concerned, furnishing mainly transportation, terminal and aeronautical industrial facilities

2 That amusement concessions in any case should be separated from flying activities

3 That where there was a danger of concessions running wild under outside operators at some point adjoining the airport it was better for the city to maintain control itself

4 That hangar lessees should have the privilege of owning and operating their own gasoline and oil equipment for their own use but should not sell to transients

5 That fuel prices should be standardized and should not be exclusive to any one fuel company unless perhaps, when handled by the airport management

6 That the best way to handle restaurant concessions is to secure a guaranteed monthly minimum with a percentage basis beyond that Vending on the field should be in the hands of the restaurant concessionaire

THE COMMITTEE on small town airports chairmaned by Frank L Bertschler, manager of the airport at Beaumont Tex, made the following recommendations:

1 That the Aeronautical Chamber undertake the promotion of airports in small communities through contacts with civic clubs and others, and that the small airports committee be made a permanent body in the Chamber's organization

2 That there should be an airport in every community, no matter how small for the following reasons (a) It is fundamentally correct city planning to prepare for future developments along all lines (b) It is economically justified as opening up another source or avenue, of revenue (c) Because it automatically makes accessible the newest and fastest form of transportation

THAT TRAFFIC is fast becoming a major problem at many airports was brought out in the report, and ensuing discussion, of the committee assigned to study the subject C W Short, Jr, manager of the Tulsa

Municipal Airport, read the committee's report and its recommendation that a standard code of air traffic regulations be established at all airports As a first step in this direction, a set of rules was suggested

After much discussion this movement was temporarily shelved, pending the outcome of the study of the same problem, now well under way, on the part of the Aeronautics Branch The government's work in this field has been under way for many months and a report should be forthcoming before long

Discussion developed over some of the salient points in the above-mentioned suggested rules and it was apparent that the regulation requiring a left turn after take off at all times was a particularly objectionable item Many ports it was shown, are so situated that such a left turn would create a real hazard on account of obstructions It was evident that such a regulation throughout the country would be confusing to say the least

Sales and advertising in the airport operation have to do with getting the airport "across" to all possible clients—from the public to manufacturers who might locate there—to the end that its income may be as large as possible Obviously this is of more concern to the commercial airport which has been launched as an investment than it is to the municipal project, which is a good deal of a public utility However, income is of great concern to both after all, and particularly in these days when the ledger is more apt to show red ink than black

The subject was taken up by a committee headed by Robert F Craig, assistant to the president of Fairfax Airport, Kansas City, Kan The report emphasized the necessity of applying every means of sales effort to attract public and professional patronage of the port and discussed the many methods of making these applications

These methods are quite generally recognized They include selling to a prospective airplane purchaser the conviction that a certain airport is equipped to give him better service than a rival field, creating the reputation of adequate safe-guards for handling passengers and regulating the crowds of spectators, selling a manufacturer or an airline company the idea that a certain airport, offers facilities better than another field, etc

In other words, the committee brought to the attention of the conference the fact that rival airports or ports having a financially hard time must resort to all the refinements of the art of salesmanship to attract the income needed for successful operation This salesmanship starts with the airport manager and, if carried out to its full possibilities, will include every man working at the field It is an example of how the force of healthy competition may operate in our airport system to bring about highly developed plants which otherwise would not be realized, at least so soon

H H Mills manager of Brainard Field at Hartford Conn reported that the committee on service and storage, of which he was chairman recommended the same principles for determining costs should apply to commercial and municipal hangars alike that hangars should afford about a 10 per cent net profit, and that the kind of storage and service should be standard throughout the country It was felt that charges for this service must vary with the location on account of differences in building and operating costs

It was urged that consideration be given to the rating of service at airports in the same manner ports are rated for general facilities, lighting and size of landing area A standard price of $0.30 per gallon for gasoline and $0.35 per quart of oil were proposed

On the evening of the second day, the conference banquet was held The speakers included Capt Sir Hubert Wilkins, Charles S (Casey) Jones, M. B Rodgers, vice-president of the United States Lines and Senator J Griswold Webb, chairman of the New York state aviation commission

Most city governments are floundering around in confusion over what policies should be adopted regarding many aspects of municipal airport development and operation, Col C O Sherrill, former city manager of Cincinnati, declared at the morning session, Friday, May 16

W R Gregg, Weather Bureau who spoke at closing session Friday May 16

Their uncertainties revolve around such questions for instance, as whether hangars on municipal airports should be built by the city or operating company what is the best type of management for an individual airport, whether or not flying schools not approved by the government should be permitted to operate at a field in competition with approved schools, how far a city should go in the direct control of such activities as sale of fuel, operation of restaurant, hotels, etc.

The panacea for all this lies in the formation somehow of a national policy for the guidance of cities interested in airport development, Col Sherrill declared He urged a nation wide survey of the entire municipal airport situation, affirming his belief that there must be a best way to meet all the problems now perplexing the average city port He suggested the possibility of individual unit or chain ownership or operation of terminals after the fashion of many railroad and steamship terminals today

At the Friday morning session W R Gregg chief of the Aerological Division, Weather Bureau, Washington stated firmly his conviction that the responsibility of making the decision regarding carrying out a flight in doubtful weather should not be shifted from the pilot to the weather bureau representative This question of responsibility has been rather a prominent one along the airways recently and this statement from Mr Gregg indicated that no change is contemplated in the long-standing policy of the Bureau in this regard

Taking everything into consideration the conference was extremely worth while What punch was lacking could have been supplied, I believe, by the introduction of a larger element of representation from the Aeronautics Branch and have a more alert local committee The former would have been able to contribute much toward the filling out of the complete "round table" and the latter could have tied up the majority of the occasional loose ends On the whole the Aeronautical Chamber of Commerce deserves considerable credit for the program it staged

MANUFACTURERS' SPECIFICATIONS ON ENGINES AVAILABLE FOR COMMERCIAL USE AS COMPILED BY *AVIATION*

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT *AVIATION* DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

This table will appear monthly and corrections and suggestions are invited

Manufacturer or Agent	Engine	Cooling System	Cylinder Arrangement	No of Cylinders	Strokes per Cycle	Propeller Drive	Rated Hp and R P M at Sea Level	Maximum Hp and R P M at Sea Level	Weight Dry Without Hub or Starter	Weight Per Rated Hp	Bore and Stroke (in)	Compression Ratio	B M E P	Displacement (Cu in)	Frontal Area (Sq Ft)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Specifications of American Commercial Airplanes

Including only planes with Approved Type Certificates—*AVIATION does not assume responsibility for the figures given*

		GENERAL							POWER PLANT						
Manufacturer	Designation	A.T.C. No	Price at Factory	Type	No. of Seats	Span	Length Overall	Height Overall	Make Engine	Total Rated Hp.	R.p.m. at Rated Hp.	Fuel Cap. (Gal.)	Normal Range	Fuel Consumption at Cruising Speed Gal per Hr.	Make of Prop.
Alexander Aircraft Co	Eaglerock A-2	58	[illegible]	OBL	3	36 8	24 11	9 10	OX-5	90	1,400	40	435	10 5	[illegible]
Alexander Aircraft Co	Eaglerock A-12	159	3,247	OBL	3	36 8	24 11	9 10	Cr	130	1,800	40	500	8 0	Mc
Alexander Aircraft Co	Eaglerock A-15	181	3,907	OBL	3	36 8	25 11	9 10	K	90	1,825	40	500	6 0	W
American Aeronautical Corp	S-55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
American Eagle Aircraft Corp	Eaglet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
American Eagle Aircraft Co	Phaeton II 540	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
American Eagle Aircraft Co	201	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
American Eagle Aircraft Co	A-601	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Arrow Aircraft & Motors Corp	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bach Aircraft Co	CT-9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pwh Z Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bach Aircraft Co	3-CT-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww 2 Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bellanca Aircraft Corp	Pacemaker	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bellanca Aircraft Corp	CH 300 Seaplane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bellanca Aircraft Corp	Skyrocket	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brunner-Winkle Aircraft Corp	Bird Model A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brunner-Winkle Aircraft Corp	Bird Model B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buhl Aircraft Co	CA-3C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buhl Aircraft Co	CA-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buhl Aircraft Co	CA-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pwh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buhl Aircraft Co	CA-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buhl Aircraft Co	CA-3D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cessna Aircraft Co	DC-6A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cessna Aircraft Co	DC-6-B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	War	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Command-Aire Inc	3C3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Command-Aire Inc	5C-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cir	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Command-Aire Inc	3C3-B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Command-Aire Inc	5C3 Ax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Ax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Consolidated Aircraft Corp	Commodore	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 Pwh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Courier Monoplane Co	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crown Motor Carriage Co	Courtomobile B-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cunningham-Hall Aircraft Corp	PT 6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss-Wright Corp															
Curtiss Aeroplane & Motor Co	Carrier Pigeon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cu Cn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co	Fledgling	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cu Ch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co	Fledgling K2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co	Condor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 Cu Cn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss-Robertson Airpl Mfg Co	Robin OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss-Robertson Airpl Mfg Co	Robin R-600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cu Ch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss-Robertson Airpl Mfg Co	Robin J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss-Robertson Airpl Mfg Co	Thrush J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Keystone-Loening Aircraft Corp	Air Yacht	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pwh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Keystone-Loening Aircraft Corp	Commuter	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Keystone-Loening Aircraft Corp	Patrician	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 Cy, 3 Pwh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Moth Aircraft Corp	Gipsy Moth 60GM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Gy	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Travel Air Mfg Co	6000 B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Travel Air Mfg Co	6000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Travel Air Mfg Co	4000-B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Travel Air Mfg Co	4-D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Davis Aircraft Corp	D-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Davis Aircraft Corp	D-1-K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Detroit Aircraft Corp															
Eastman Aircraft Corp	Flying Yacht	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cu Ch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lockheed Aircraft Co	Air Express	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lockheed Aircraft Co	Vega Model 5B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Parks Air College Inc	P-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ryan Aircraft Corp	B-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Wr Ww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ryan Aircraft Corp	B-7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Doyle Aero Corp	O-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Aviation Corp	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Aviation Corp	FC-2W2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pww	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Aviation Corp	KR 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OX 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Aviation Corp	KR 34A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cu Ch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Aviation Corp	KR 21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fleet Aircraft Inc.	Model I	122	[illegible]	OBL	2	28	21	8 9	War	110	1,850	24	340	6 0	StS Hs
Fleet Aircraft Inc.	Model II	131	4,985	OBL	2	28'	20 9	8' 9	K	90	1,825	24	360	6 0	StS Hs
Fokker Aircraft Corp	F 10A	9	62,500	CML	12	79 3'	50	12 0	3 Pww	1,275	1,800	360	765	65 0	StS
Fokker Aircraft Corp	Universal	164	15,000	CML	4	47 9"	33 6	8'	Wr Ww	300	2,000	75	525		StS
Fokker Aircraft Corp	F 11A	22	42,000	CML	11	59'	45 10	15'	Pwh Cy	525	1,800	120	425	21 0	StS
Fokker Aircraft Corp	F 14	23	26,500	CML	6	59'	43' 4	12 11	Pwh	525	1,800	170	750	26 0	StS

A —Amphibian	Cd —Cord	Fl —Flottorp	K —Kinner	Ol —Oleo	Ry —Riveted	T —Tubing
Ad —Alclad	Cg —Corrugated	G —Glued	Kh —Kelsey Hayes	Old —Oildraulic	S —Steel	Tr —Trombone
Aer —Aerol	Ch —Challenger	Ge —Genet	L —Landplane	Op —Optional	Sa —Sausedde	Tred —Treadle
Al —Axle	Cir —Cirrus	Go —Goodyear	La 1 —Ace	OX-5 —Curtiss	Se —Sewed	Trs —Truss
Ans —Ansani	Co —Comet	Gr —Grass	Lam —Lambert	P —Paragon	Sc —Coil Springs	Ts —Tucked and sewn
Apl —Applied	Com —Compression	Gt —Gov't test	Lb —LeBlond	Pe —Pedal	Scd —Screwed	W —Wood
Ar —Arena	Con —Continental	Gy —Gipsy	Lr —Liberty	Pk —P K screws	Sd —Stamped	Wa —Warren Truss
Aw —Air Wheels	Cq —Conqueror	H —Hamilton	Lk —Lockheed	Ply —Plywood	Sh —Sheet	War —Warner
Ax —Axelson	Cs —Shock Cord	Hr —Henderson	Lmd —Laminated	Pn —Pneumatic	Sk —Stork	We —Westinghouse
B —Biplane	Cu —Curtiss	Hs —Hispano	Lr —LeRhone	Pr —Push Rod	Sol —Solid	Wh —Wheel
Bak —Bakelite	Cv —Conventional	Ht —Heat treated	Ly —Lycoming	Pwh —P & W Hornet	Sp —Spruce	Wi —Wire
Be —Beam	Cy —Cyclone	Hw —Hess Warrior	M —Monoplane	Pwj —P & W Wasp Jr	Spl —Split	Wl —Welded
Bo —Bolted	D —Duralumin	Hyd —Hydraulic	Me —Metal	Pww —P & W Wasp	Sr —Super Rhone	Wr —Wright
Box —Box spar	Dep —Deperdussin	Hz —Hartzell	Mo —Monocoupe	Q —Sesquiplane	St —Standard	Wt —Wind Tunnel
Br —Brownback	Du —Dual	I —I section	Ms —Mfr's statement	R —Rubber	Str —Straight	Ww —New Whirlwind
Bx —Bendix	Ex —Extra	In —Internal	N —New	Re —Reed	Su —Supreme	Y —Yankee
C —Closed	F —Flying boat	Ir —Irwin	Na —Navigation	Ro —Routed	Sy —Story	Z —Seaplane
Ca —Cable	Fab —Fabric		O —Open	Rus —Russo	Ss —Sackely	* —Without engine
Can —Cantilever						

		GENERAL							POWER PLANT						
Manufacturer	Designation	A.T.C. No	Price at Factory	Type	No. of Seats	Span	Length Overall	Height Overall	Make Engine	Total Rated Hp.	R.p.m. at Rated Hp.	Fuel Cap. (Gal.)	Normal Range	Fuel Consumption at Cruising Speed Gal per Hr	Make of Prop
Fokker Aircraft Corp	F-32	281	110,000	CML	32	99	69 10	16 6	4 Pwh	2,100	1,800	400		108	StS
Fokker Aircraft Corp	Super Universal	52	21,000	CML	6	50 7	36 7	9 11	Pwh	425		126	420		
Ford Motor Co	4-AT-F	132		CML	11	74'	49 10	11 9	3 Wr Ww	900	2,000	231	550		StS, H
Ford Motor Co	5-AT-C	165		CML	15	77 10	49 10	12	3 Pww	1,250	1,900	277	510		StS, H
Ford Motor Co	7-AT	246		CML	13	77 10	49'10"	12'	2WrWw Pww	1,020	2,000	231	815		StS, H
Ford Motor Co	5-AT-C-S	296		CSM	13	77 10	51' 4"	14' 6"	3 Pww	1,275	1,800	277	490		
General Airplanes Corp	Aristocrat	117	4,250	CML	3	56 4	25 4	7 9	War	110	1,850	42	600	5 0	StS
General Airplanes Corp	Aristocrat 102-F	219	5,250	CML	5				Ww	165					
General Airplanes Corp	Chair 111-C	22	4,000	OML	2				War	110					
Great Lakes Aircraft Corp	2T-1A	228	5,150	OBL	2	26 8	20 4'	8 5	Cir	90		26	390	6 0	Hz, P
Inland Aviation Co	S-300	255		OML	2	30'	20	7 7	Lb	65	1,950	24			
Ireland Aircraft, Inc	N-2-B	153	10,000	CBA	4	40	31	12' 2	Wr Ww	300	2,000	60	450	15 0	StS
Ireland Aircraft, Inc	N 2-C	248	25,000	CBA	5	40	31	12 2	Pww	420	2,000	80	450	18 0	StS
E. M. Laird Airplane Co	LC-R-300	17	11,500	OBL	3	28	22 9	9'	Wr Ww	300	2,000	76	550		H
Lincoln Aircraft, Inc	PT	101	*1,985	OBL	2	32' 3	25 7	8 10	OX 5	90	1,400	30	300	8 0	H Hs
Lincoln Aircraft, Inc	PT K	279	3,865	OBL		32' 3	25' 7"		K	90	1,825				
Lincoln Aircraft, Inc	PT W	284	4,315	OBL		32 3	25' 3"		War	110	1,850				
Mercury Aircraft Inc	Chic	235	3,950	OML	2	35 0	25	8 7	Lb	90	2,050	20	375	7	Hs
Metal Aircraft Corp	G-2-W	192	21,000	CML	6	50	32 6	8' 6"	Pww	425	1,900	140	700	22 0	StS
Mohawk Aircraft Corp	Pinto	263	4,800	OML	2	34 11	24' 2"	7' 7	K	90	1,825	37	550	7 0	Hr StS
Mohawk Aircraft Corp	M 1-C	297		OML	2	34 11'	24' 2'	7' 7	War	110	1,850	37	550	7 0	Hs StS
Mono Aircraft Corp	Monoprep	218	2,835	CML	2	32'	21'		Lam	55	2,000				
Mono Aircraft Corp	Monosport	250	5,750	CML	2	32 2'	21' 5'		K	90	1,825				
Mono Aircraft Corp	Monocoach	275	6,250	CML	4	39'	26 9'		Wr Ww	225	2,000				
New Standard Aircraft Corp	D-29-A	216	4,475	OBL	2	30'	24' 9"	8'	K	90	1,825	22			P
New Standard Aircraft Corp	D-25-A	224	8,750	OBL	5	45'	26' 6"	10 2	Wr Ww	225	2,000	62			P
New Standard Aircraft Corp	D-27 A	220	[illegible]	OBL	1	45'	26' 6'	10' 2	Wr Ww	225	2,000	62			P
Nicholas-Beazley Airplane Co., Inc	Barling NB 3	174	3,600	OML	3	32' 9'	21'11"	7' 5	Lb	60	1,950	18	580	4 2	W
Nicholas-Beazley Airplane Co., Inc	Barling NB 3L	250	3,600	OML	3	32 9	22 3"	7' 3"	Lenr	70	2,200	18	380	4 2	W
Nicholas-Beazley Airplane Co., Inc	Barling NB 3G	231	3,900	OML	3	32 9	22 5"	7' 3"	Ge	80	2,200	18	400	4 5	W
Paramount Aircraft Corp	Cabinaire 165	265	7,250	CBL	4	32 2	24' 7"	9'	Wr Ww	165	2,000	50	400	12 0	H
Pheasant Aircraft Co., Inc	H-10	36	2,895	OBL	3	32 6	25' 6'	8	OX 5	90	1,400	30	400	8 0	Hs
Pitcairn Aircraft Inc	PA 7	196		OBL	3	33	23' 9"	9' 6"	Wr Ww	225	2,000	83			StS
Simplex Aircraft Corp	Red Arrow K-2-S	43	3,995	OML	2	34' 4	22' 5"	7' 1"	K	90	1,825	44	600	6 5	W
Simplex Aircraft Corp.	Red Arrow W-2-S	238	4,495	OML	2	34' 4	22 3'	7 1	War	110	1,850	44	550	7 0	W
Spartan Aircraft Co	C-3-165	195	5,975	OBL	3	32	23 10	8'10	Wr Ww	165	2,000	85	600	10 0	StS H
Spartan Aircraft Co.	C-3-225	206	7,750	OBL	3	32	23 3'	8 10	Wr Ww	225	2,000	80	496	13 0	StS H
Spartan Aircraft Co	C 3-166	290	5,675	OBL	3	32	23 4	8'10	Co	165	1,900	65	550	10 0	StS, H
Spartan Aircraft Co	C4-225	310		CML	4	25	31 6	9	Ww	225	2,000	65			
Star Aircraft Co	Cavalier C	255	2,985	CML	2	31' 6	19 8	6' 3	Lb	60	1,950	25	500	5 0	
Stinson Aircraft Corp	SM 6 B	212	15,995	CML	6	52' 8	34' 4	8' 0'	Pww	425	1,900	119	825	23 0	StS
Stinson Aircraft Corp	SM 8 B	[illegible]	9,495	CML	6	41' 8	29 4		Wr Ww	225	2,000				
Stinson Aircraft Corp	Detroiter	[illegible]	10,995	CML	6	47 1	32 0		Ww	300					
Stinson Aircraft Corp	SM 8 A Jr	295	5,775	CML	4	41 8	28 11	8' 9	Ly	210	2,000				Mc
Stinson Aircraft Corp	SM 7 A	[illegible]	10,495	CML	6	41 8	31		Wr Ww	300	2,000				
St Louis Aircraft Corp	Cardinal C-2-110	277	5,985	CML	2	32 4	21 3	7	K	90	1,825	50	450	6 5	Hs
St Louis Aircraft Corp	Cardinal C-2-90	264	[illegible]	CML	2	32 4	21 3	7'	Lb	90	1,950	50	425	7 0	Hs
St Louis Aircraft Corp	Cardinal C-2-65	275	3,250	CML	2	32 4	21 3	7'	Lb	65	1,950	25	350	5 0	Hs
Swallow Airplane Co	TP	105	2,875	OBL	2	30 11	23' 1"	8' 7	OX 5	90	1,400	25	300	7 0	W
Swallow Airplane Co.	F 28-Ax	125		OBL	3	32'	22 7"	8' 7'	Ax	150	1,800	82	600	9 5	W
Swallow Airplane Co	TP K	186		OBL	2	30 11	24 1'	8 7'	K	90	1,825	28	550	5 5	W
Swallow Airplane Co	TP W	253		OBL	2	30 11'	25' 9	9' 7	War	110	1,850	28	350	5 5	Mc
Texas Aero Corp	Temple	45	—	OML		39 4	25 10	9' 5	Wr Ww	200	2,000	50			
United Aircraft and Transport Corp															
Boeing Airplane Co	100	155	20,000	OBL	1	58'	20 0"	9' 7	Pww	450	1,900	97	525	20 0	H
Boeing Airplane Co	204	157		CBF	5	39 8	32 6	12'	Pww	450	1,900	80	530	20 0	Mc
Boeing Airplane Co	40 B-4	195		CBL	4	44 2	33 4'	11' 9	Pwh	525	1,900	140	450	25 0	Mc
Boeing Airplane Co	80-A	206		CBL	18	80	55	15' 2	3 Pwh	1,575	1,900	400	500	90 0	Mc
Hamilton Metalplane Co.	H-45	85	24,500	CML	8	54 5	34' 8"	9' 4	Pww	425	1,900	140	600	21 0	H
Hamilton Metalplane Co.	H 47	94	26,000	CML	8	54 5	34' 8"	9' 4	Pwh	525	1,900	140	600	25 0	H
Sikorsky Aviation Corp	S-38	126		CQA	12	71 8	45'	15'10'	2 Pww	850	1,900	264	700	44 0	H
Stearman Aircraft Co	LT-1	197	[illegible]	CBL	5	49	32' 6"	12' 8	Pwh	525	1,900	145	720		StS
Stearman Aircraft Co.	C 3-R	251	8,500	OBL	5	35	23 11"	9' 3'	Wr Ww	225	2,000	86	650	10 0	StS
Stearman Aircraft Co	4 E	292		OBL		38'	26 4"		Pww	425	1,900		650		
Viking Flying Boat Co	Kittyhawk B-2	134	5,500	OBL	3	28	22' 6"	8' 8	Y	105	1,720	55	500	6 0	Hs
Viking Flying Boat Co	Kittyhawk B-4	166	4,800	OBLZ	3	28	22 11"	8' 8	K	90	1,825	35	500	6 0	Hs StS
Waco Aircraft Co	90	13	2,145	OBL	3	30 8	25' 6"	9'	OX 5	90	1,400	37		8 0	Hs
Waco Aircraft Co	165	168	6,370	OBL	3	30 8	23	9'	Wr Ww	165	2,000	65		10 0	H, Hs
Waco Aircraft Co.	225 air. w	240	7,335	OBL	3	30' 8	22 6'	9' 2'	Wr Ww	225	2,000	65		12 0	H Hs
Waco Aircraft Co.	225 tap. w	257	8,525	OBL	3	30' 5	22 6'	9'	Wr Ww	225	2,000	87		12 0	Mc
Warrior Aircraft Corp	Arao	170	4,500	OBL	2	28 8'	20' 9	9 1'	Hw	115	1,925	55	425	8 0	StS

Ace —La 1	Challenger —Ch	Fabric —Fab	Irwin —Ir	Open —O	Seaplane —Z	Treadle —Tred
Aerol —Aer	Cirrus —Cir	Flottorp —Fl	Kinner —K	Optional —Op	Sesquiplane —Q	Trombone —Tr
Air Wheels —Aw	Closed —C	Flying Boat —F	Kelsey Hayes —Kh	Paragon —P	Sewed —Se	Truss —Trs
Alclad —Ad	Coil Springs —Sc	Genet —Ge	Lambert —Lam	Pedal —Pe	Sheet —Sh	Tubing —T
Amphibian —A	Comet —Co	Gipsy —Gy	Laminated —Lmd	P K Screws —Pk	Shock Cord —Cs	Walter —Wa
Ansani —Ans	Compression —Com	Glued —G	Landplane —L	Plywood —Ply	Solid —Sol	Warner —War
Applied —Apl	Conqueror —Cq	Goodyear —Go	Le Blond —Lb	Pneumatic —Pn	Split —Spl	Welded —Wl
Arena —Ar	Continental —Con	Gov't Test —Gt	LeRhone —Lr	Push Rod —Pr	Spruce —Sp	Westinghouse —We
Axelson —Ax	Conventional —Cv	Grass —Gr	Liberty —Li	P & W Hornet —Pwh	Stamped —Sd	Wheel —Wh
Axle —Al	Cord —Cd	Hamilton —H	Lockheed —Lk	P & W Wasp Jr —Pwj	Standard —St	Whirlwind —Ww
Bakelite —Bak	Corrugated —Cg	Hartzell —Hz	Lycoming —Ly	P & W Wasp —Pww	Steel —S	Wire —Wi
Beam —Be	Curtiss —Cu	Heat Treated —Ht	Metal —Me	Reed —Re	Stork —Sk	Wind Tunnel —Wt
Bendix —Bx	Curtiss —OX-5	Henderson —He	Mfr's Statement —Ms	Riveted —Ry	Story —Sy	Wood —W
Biplane —B	Cyclone —Cy	Hess Warrior —Hw	Monocoupe —Mo	Routed —Ro	Straight —Str	Wright —Wr
Bolted —Bo	Duralumin —D	Hispano —Hs	Monoplane —M	Rubber —R	Super Rhone —Sr	Yankee —Y
Box Spar —Box	Deperdussin —Dep	Hydraulic —Hyd	Navigation —Na	Russo Aero Rings —Rus	Supreme —Su	Without Engine —*
Brownback —Br	Dual —Dual	"I" Section —I	New —N	Sausedde —Sau	Sackely —Ss	
Cable —Ca	Extra —Ex	Internal —In	Oildraulic —Ol	Screwed —Scd	Tucked and Sewn —Ts	
Cantilever —Cn			Oleo —Ol			

AVIATION May 24 1930 1045

Specifications of American Commercial Airplanes

Including only planes with Approved Type Certificates—*AVIATION* does not assume responsibility for the figures given

Manufacturer	WEIGHTS: Wing Loading (Lb per Sq Ft)	Power Loading (Lb per Hp)	Weight Empty with Water if Water Cooled Engine is Used (Lb)	Pay Load (Lb)	Gross Weight (Lb)	WINGS: Spars: Material	Spars: How Fabricated—Section	Ribs: Material	Ribs: How Fabricated	Covering: Material	Covering: How Attached	FUSELAGE OR HULL: Framework: Material	Framework: How Fabricated	Covering: Material	Covering: How Attached	Cockpit Dimensions	Cabin Dimensions	Minimum Headroom	Vol Baggage Comp.
Alexander Eaglerock A 2	2 40	12 60	1 45?	340	2 442	Sp	G	Sp	G Bo	Fab	Te	ST	Wl	Fab	Te				
Alexander Eaglerock A 12	7 63	17 2	1 495	340	2 582	Sp	G	Sp	G Bo	Fab	Te	ST	Wl	Fab	Te				
Alexander Eaglerock A 13	6 16	15 64	1 53?	340	2 456	Sp	G	Sp	G Bo	Fab	Te	ST	Wl	Fab	Te				
American Aeronautical S 56	7 3	21 3	1 442	342	2 150	Sp	G Box	Sp	G	Fab	Sd Bo	ST	Wl	Fab	Sd	3 x4 6			
American Eagle Phaeton	11 95	11 61	1 ???	340	2 100	Sp	Lmd	Sp	G	Fab	Se	ST	Wl	Fab	Se				
American Eagle Phaeton E 360	12 08	18 18	1 368	421	2 625	Sp	Lmd	Sp	G	Fab	Se	ST	Wl	Fab	Se				
American Eagle 202			1 778	405	2 ???	Sp	Lmd	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Arrow A2-60 L	2 55	19 5	988	120	1 346	W	G	W	G	Fab	Se	ST	Wl	Fab	Se	34x36			5 0
Bach 3-CT-8	14 9	9 59	4 785	1 378	6 000	W	G Box	Ply	G	Ply	G	W	G Bo	Ply	G	40x48	46 x11	5	50 0
Bach 3-CT-9	14 9	8 9	3 010	1 525	6 000	W	G Box	Ply	G	Fab	Se	W	G	Fab	Se	40x40	46 x11	5	30 0
Bellanca Pacemaker	15 74	14 32	2 565	1 042	4 300	Sp	Bol	Sp	G	Fab	Sd	ST	Wl	Fab	Se				18 0
Bellanca CH 300 Pacemaker	17 16	16 1	2 565	1 042	4 300	Sp	Bol	Sp	G	Fab	Sd	ST	Wl	Fab	Se				12 0
Berliner-Joyce	16 82	15 55	2 780	615	4 ???	Sp	Bol	Sp	G	Fab	Sd	ST	Wl	Fab	Se				16 0
Brunner Winkle Bird Model A	8 1	24 8	1 308	480	2 130	W		W		Fab		ST	Wl	Fab					
Brunner Winkle Bird Model B	9 3	22 0	1 310	480	1 980	W		W		Fab		ST	Wl	Fab					
Buhl CA-3 A	13 42	12 0	1 542	390	2 600	Sp	Box G	Sp	G	Fab	Sn	ST	Wl	Fab	Sn		13 x4 6	4 7	50 0
Buhl CA-6	15 42	12 5	3 342	1 390	4 500	Sp	Box G	Sp	G	Fab	Sn	ST	Wl	Fab	Sn		13 x4 6	4 7	50 0
Buhl CA-8	14 5	15 0	2 478	1 152	4 500	Sp	Box G	Sp	G	Fab	Sn	ST	Wl	Fab	Sn		11 x4 4	4	24 0
Buhl CA-3 D	13 3	19 66	1 542	413	3 000	Sp	Box G	Sp	G	Fab	Sn	ST	Wl	Fab	Sn		10 x4 2	4	18 0
Cessna DC-6-A	11 07	10 6	1 832	610	3 180	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Ta	58x40	38 x42		18 0
Cessna DC-6-B	11 57	15 19	1 821	610	3 180	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Ta	50x40	38 x42		18 0
Command-Aire 3-C-3A	7 1	19 5	1 270	340	2 145	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se	30x33			4
Command-Aire 3-C-3B	6 9	12 6	1 400	340	2 230	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se	30x33			4
Command-Aire 5-C-3	6 2	13 9	1 446	310	2 365	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se	30x33			4
Command-Aire 5-C-3 Ch	6 2	12 9	1 394	310	2 331	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se	30x33			4
Consolidated Commodore	15 8	15 3	9 785	2 778	17 600	D	Rv	D	Rv	D	Bo	D	Rv	D	Rv		8 5 x18 4	6	200
Courier P B 1	9 5	20 0	1 323		2 100	Sp	Box	Sp	Sq	Fab	Se	St	Wl	Fab	Se	36			
Crown Custombuilt B 3	7 62	17 36	1 242		1 256	Sp		Sp		Fab	Se	Ply	Wa	Fab	Ply	Ms			
Cunningham-Hall PT-6	11 7	13 5	2 670	920	4 500	Sp	Bo	Sp	Ply Cy	Fab	Se	ST	Wl	Fab	Se	Rv 45x40	42 x75	69	27
Curtiss-Wright Corp																			
Curtiss Carrier Pigeon	15 82	11 96	4 235		7 600	ST	Wl	D		Fab	Se	Ms	Ms Ro	Fab					
Curtiss Fledgling Ch						Sp	Lmd	Ply	G	Fab	Se	Fab	Wl	Fab	Se				
Curtiss Fledgling Ch 2						Sp	Lmd	Ply	G	Fab	Se	ST	Wl	Fab					
Curtiss Condor	11 5	14 47	11 352	5 600	17 368	D	Rv	D	G	Fab	Se	ST	Wl	Fab	Se		94 x32	41	150
Curtiss Robin OX-5	8 94	24 14	1 489	520	2 271	W		W	G	Fab	Se	ST	Wl	Fab	Se		94 x32	41	150
Curtiss Robin B 4	10 7	15 29	1 706	454	2 440	W		W	G	Fab	Se	ST	Wl	Fab	Se		94 x32	41	150
Curtiss Robin-J	10 4	14 0	1 615	590	2 515	W		W	G	Fab	Se	ST	Wl	Fab	Se		11 n37	41	
Curtiss Thrush-J	14 2	16 7	2 290		3 800	W		W	G	Fab	Se	ST	Wl	Fab	Se		10 x4		
Keystone Air Yacht	14 1	11 25	5 095	1 150	8 250	Sp	Bo	Sp	G	Fab	Se	D	Ro				8 4 n4		
Keystone Commuter	14 55	13 7	2 060		3 800	Sp		Sp		Fab	Se	D	Ro				20 x4 6		
Keystone Pathfinder	16 9		10 353	4 465	18 690	D	Rv	D	Rv	Fab	Se	D	Rv						
Travel Air 4000 A	7 8	20 7	1 530	383	2 250	Sp	Box	Sp	Tre	Fab	Se	ST	Wl	Fab	Se	19x21			
Travel Air 10 D 6	12 4	18 6	1 950	285	3 400	Sp	Box	Sp	Tre	Fab	Se	ST	Wl	Fab					
Travel Air A 5000-A	8 1	12 2	1 890			Sp	Box	Sp	Tre	Fab	Se	ST	Wl	Fab			115 x55		
Travel Air 6000-B	11 8	13 1	2 900	975	4 250	Sp	Box	Sp	Tre	Fab	Se	ST	Wl				113 x53		
Travel Air 4 E	10 5	12 3			2 710	Sp	Box			Fab	Se	ST	Wl						
Travel Air 4-D	10 0	12 9	1,857		2 900	Sp	Box	Sp	G	Fab	Se	ST	Wl						
Davis D 1	9 2	19 1	940	190	1 335	Sp	Lmd	D	Sd	Fab	Se	ST	Wl	Fab	Se				
Davis D 1 K	10 0	15 9	925	197	1 355	Sp	Lmd	D	Sd	Fab	Se	ST	Wl	Fab	Se				
Detroit Aircraft Corp																			
Eastman Flying Yacht	11 65	16 0	1 745	575	2 725	Sp	Box	Sp	Wa	Fab	Se	W		D	Ro				
Lockheed Air Express	15 20	10 4	2 533	1012	4 375	Sp	Box	Sp	G	Ply		Mo	Ply	G					
Lockheed Vega Model 5 B	14 20	12 4	2 455	1 160	4 265	Sp	Box	Sp	G	Ply		Mo	Ply	G					1 3
Parks P 1	6 41	23 0	1 241	323	2 028	W	Ro	Sp	Ply G	Fab	Te	ST	Wl	Fab	Se	50x33			2
Ryan B-1	14 3	15 3	2 300	918	3 300	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se		114 x47	47	20
Ryan B-7	15 5	10 2	2,500	950	4 255	W	G	Sp	G	Fab	Se	ST	Wl	Fab	Se		114 x47	47	28
Doyle O-2	6 0	15 2	1 570		1 500	Sp	Box	Sp	G	Fab	Se								
Fairchild 42	14 8	14 5	2,730		4 300	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se		55 x44	48	55
Fairchild 71-A	14 4	10 5	3 180		5 500	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se		9 n5	54	145
Fairchild KR-31	7 8	23 0	1 270		2 000	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Fairchild KR 34	8 4	16 5	1 402		2 150	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Fairchild KR 21	8 02	12 02	1 015		1 650	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se				1 5
Fleet Model 1	8 03	11 8	1 030	224	1 580	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Fleet Model 11	8 04	14 5	1 010	221	1 575	Sp	Box	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Fokker F 10 A	11 05	11 3	7 700	2 520	13 000	W	Box	Sp	Ply G	Ply	G	ST	Wl	Fab	Se		190 n68		65 3
Fokker Universal	15 05	14 35	2 432	1 180	4 300	W	Box	Sp	Ply G	Ply	G	ST	Wl	Fab	Se		93 n41		
Fokker F 11 A	13 8	13 55	4 470	1 295	6 900	W	Box	Sp	Ply G	Ply	G	D	Wl	D	Rv		152 n54		46 8
Fokker F-14	12 13	15 35	4 034	1 608	7 000	W	Box	Sp	Ply G	Ply	G	ST	Wl	Fab	Se		114 n44		5 3
Fokker F 32	15 10	10 75	14 200		22 500	W	Box	Sp	Ply G	Ply	G	ST	Wl	Fab	Se				72
Fokker Super Universal	15 80	15 6		1 385	3 270	W	Bo	Sp	Ply Sp	G	Ply	G	ST	Wl	Fab		93 n58		133 0
Ford 4-AT-E	15 46	12 6	6 500	1 725	10 130	D	Rv	D	Sd	D	Rv	Ms	Rv	D	Rv		4 6 'x10 5	3 6	50
Ford 5-AT-C	16 16	10 7	7 500	3 743	13 500	D	Rv	D	Sd	D	Rv	Ms	Rv	D	Rv		4 6 'x18 9"	5 6	30
Ford 7 AT	15 46	12 6	7 280	3 380	12 910	D	Rv	D	Sd	D	Rv	Ms	Rv	D	Rv		4 6 'x18 n	5 6	30
Ford 5 AT C-8	16 2	10 2	6 900	2,345	13,500	D	Rv	D	Sd	D	Rv	Ms	Rv	D	Rv		4 6 'x18 9	3 6	50
General Aristocrat	10 84	19 20	1 322	340	2,1??	Sp	Sel	Sp	G	Fab	Se	ST	Wl	Fab	Se		2 11 x8 0	4 4	2 5
General Aristocrat 102-E	13 95	11 6	1 524		2,300	Sp	Lmd	Sp, Ply	Trs	Fab	Se		Wl	Fab	Se		7 3 n2 11'	4 4	7 0
General Cabin 111-C	8 64	15 85	1 206		2 241	Sp	Lmd	Sp Ply	Trs	Fab	Se		Wl	Fab	Se	34 x3 4			
Great Lakes 2T 1A	8 45	12 58	1 002	197	1 580	Sp	Rol	D Sh	Sd	Fab	Se		Wl	Fab	Se	28			
Inland S 300	8 97	19 5	765	195	1 292	Sp	Ro	W		Fab	Ta	ST	Wl	Fab	Se				
Ireland N-2-B	11 4	10 4	2,900	600	4 500	Sp	Ro	D	Sd	Fab	Se	ST	Wl	D	Rv		60"x40	4'	
Ireland N 2 C	15 0	11 5	3 240	900	4 900	Sp	Ro	D	Sd	Fab	Se	ST	Wl	D	Rv		60"x40	4'	
Laird LC R-300	15 3	10 6	1 922		5,010	W		W	G	Fab	Se	DT		Fab	Se				
Lincoln PT	6 6	21 1	1 290	395	1 800	Sp		W		Fab	Se	ST	Wl	Fab	Se	24n42"			
Lincoln PT-K	6 0	20 0	1 126		1 267	Sp		W		Fab	Se	ST	Wl	Fab	Se	24n42			
Lincoln PT W	6 0	16 4	1 203		1 794	Sp		W		Fab	Se	ST	Wl	Fab	Se	24x42			
Mercury Chic	7 90	16 80	935	200	1 315	ST	Wl		Wl	Fab	Se	ST	Wl			25n42			
Metal G 2-W	15 8	15 01	3 310	1 340	5 600	D	Rv	D	Rv	D	Rv	ST	Wl	D	Rv				
Mohawk Pinto	11 22	10 9	1 125	270	1 800	W		Sp		Fab	Se	ST	Wl	Fab	Se				
Mohawk M-1-C	11 72	10 9	1,125	270	1 800	W		Sp		Fab	Se	T	Wl	Fab	Se				
Mono Monoprep	9 0	23 41	783		1 28?	W		W		Fab	Se	T	Wl	Fab	Se				
Mono Monosport	12 5	15 0	1 025	407	1 650	W		W		Fab	Se	T	Wl	Fab	Se				
Mono Monocoach	15 95	13 75	1,919	750	3 092	W		W		Fab	Se	T	Wl	Fab	Se				
New Standard D 28 A	6 6	17 9	1,075	218	1 610	Sp	Lmd	Ply	G	Fab	Se	D	Rv Bo	Fab	Se				5
New Standard D-25-A	9 72	15 1	2,05?	718	3 400	Sp	Lmd	Ply	G	Fab	Se	D	Rv Bo	Fab	Se				5
New Standard D-27 A	9 7	15 1	2 055	765	3,400	Sp	Lmd	Ply	G	Fab	Se	D	Rv Bo	Fab	Se				62
Nicholas-Beazley Barling NB 3	8 6	21 12	74?	340	1 375	D	Rv	D	Rv	Fab	Se	D	Wl	Fab	Se				
Nicholas-Beazley Barling NB 3L	8 76	23 47	77?	340	1 401	D	Rv	D	Rv	Fab	Se	T	Wl	Fab	Se				
Nicholas-Beazley Barling NB 3G	8 55	17 05	735	340	1 364	D	Rv	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Paramount Cabinaire 165	8 5	15 94	1 620	310	2,650	W		W	G	Fab	Se	T	Wl	Fab	Se				
Pheasant H 10	8 0	17 25	1 292	609	2,082	Sp	G	Sp	G	Fab	Se	ST	Wl	Fab	Se				5
Pitcairn PA 7	12 5	13 55	1 820	656	3 050	Sp		Sp		Fab	Se		Wl	Fab	Se				40
Simplex Red Arrow K 2-S	11 1	19 6	1 100	245	1 705	W		W	G	Fab	Se		Wl	Fab	Se				
Simplex Red Arrow W 2-S	11 1	16 2	1 100	248	1 203	W		W	G	Fab	Se	T	Wl	Fab	Se				
Spartan C-3-165	9 0	15 85	1 630	370	2,61?	Sp	I	Sp	G	Fab	Ta	T	Wl	Fab	Se	30' x32			6 9
Spartan C-3-225	9 29	12 0	1 740	380	2,700	Sp	I	Sp	G	Fab	Ta	T	Wl	Fab	Se	30n32			6 6
Spartan C 3-166	8 61	15 10	1 657	570	2,603	Sp	I	Sp	G	Fab	Ta	T	Wl	Fab	Se	30n32			3 5
Spartan C4-225	11 75	15 62	2,325	585	3 515	Sp	Sol	Ply, Sp	G	Fab	Se	T	Wl	Fab	Se		40 x44	51	9 63
Star Cavalier C	9 0	21 5	855		1 400	Sp	Rol	Sp	Trs	Fab	Se	T	Wl	Fab	Se		43 n50	34	3 5
Stinson SM 6B	15 0	13 4	3 398	1 072	5 530	Sp	Ro	Sp		Fab	Se	ST	Wl	Fab	Se		14 n4	4 7	51
Stinson SM 1 B	15 2	14 2	2 063		3,200	Sp	Ro	Sp		Fab	Se	ST	Wl	Fab	Se		10 x5'3	4 1	20
Stinson Detroiter	15 0	14 5	2 616		4 300	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		133 x46'	4 2	45 0
Stinson SM 8 A Jr	13 7	15 6	2,061		3 193	Sp	Ro	Sp		Fab	Se		Wl	Fab	Se		9x3'3	4'1	20
Stinson SM-2 A	14 9	11 7	2,234		3 500	Sp	Ro	Sp		Fab	Se	T	Wl	Fab	Se		10 x3 3'	4 1	20
St Louis Cardinal C-2 110	9 5	12 2	1 005	566	1 569	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		55 x44	39	4 0
St Louis Cardinal C-2 90	9 5	12 7	996	573	1 569	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		35 n44	39	4 0
St Louis Cardinal C-2-65	8 0	25 0	912	556	1 450	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP	6 6	20 25	1 270	140	1 025	W		W	G	Fab	Se	T	WL	Fab	Se				
Swallow F 28-Ax	8 5	16 5	1 57?	600	2 492	W		W	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP K	5 75	19 8	1 120	120	1 200	W		W	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP W	5 8	15 5	1 201	170	1 739	W		W	G	Fab	Se	ST	Wl	Fab	Se				
Texas Temple	10 0	11 25	1 350	567	2,230	W		W	G	Fab	Se	ST	Wl	Fab	Se				
United Aircraft & Transport Corp																			
Boeing 100	11 8	5 92	1 882	40	2 250	Sp	Box	Sp	Web	Fab	Se	D	Wl, Rv	D, Fab	Bo Se	34x45"			4
Boeing 204	10 62	12 2	5 550	919	5 000	Sp	Ro	Sp	Web	Fab	Se	Ply	G Bo				52 'x9'5"	50	15
Boeing 40-B-4	11 15	11 57	5 889	1 171	6,080	Sp	Ro	Sp	Web	Fab	Se	T	Wl	D Fab	Bo Se	52x42'	38 'x48"	45'	25
Boeing 80-A	14 0	11 6	10 417	4 057	17 500	D	Bo Rv	D	Bo Rv	Fab	Se	T	Wl	Fab	Se	64n50'	63 'x19 6'	7	
Hamilton H 45	14 55	14 55	5 500	1 155	5 250	D	Rv	D	Rv	D	Rv	D	Rv	D	Rv				
Hamilton H-47	14 05	11 0	3 430	1 045	5 750	D	Rv	D	Rv	D	Rv	D	Rv	D	Rv				
Sikorsky S-38	14 3	12 5	6 300	1 900	10 480	D	Rv	D	Rv	Fab		W	Bo	Ad	Scd				
Stearman LT 1	12 26	11 90	5 050	1 215	6,250	Sp		Sp		Fab	Se	T	Wl	Fab	Se				
Stearman C-3-R	9 38	12 0	1 241	400	2,200	Sp		Sp		Fab	Se	ST	Wl	Fab	Se				
Stearman 4-E	12 82	9 32	2,454		3 950	Sp		Sp		Fab	Se	ST	Wl	Fab	Se				
Viking Kittyhawk B-2	8 13	10 1	1 159	552	1 899	Sp	Rol	W	G	Fab	Se	ST	Wl	Fab	Se				
Viking Kittyhawk B-4	8 03	16 8	1 187	542	1 875	Sp	Rol	W	G	Fab	Se	ST	Wl	Fab	Se				
Waco 90	7 03	22 5	1 199		2,025	W	Sel	W	Web	Fab	Se	ST	Wl	Fab	Se				
Waco 165	9 85	15 73	1 329		2,600	W	Sel	W	Web	Fab	Se	ST	Wl	Fab	Se				
Waco 225 str w	9 03	11 3	1,330		1 672	W	Sel	W	Web	Fab	Se	ST	Wl	Fab	Se				
Waco 225 tap. w	11 45	13 00	1 787		1 628	W	Sel	W	Web	Fab	Se	ST	Wl	Fab	Se				
Warrior Argo	2 95	14 64	1 077	200	1 645	W		W	G	Fab	Se	ST	Wl						

A —Amphibian; Ad —Alclad; Aer —Aeral; Al —Axle; Ans —Ansani; Apl —Applied; Ar —Arena; Aw —Air Wheels; Ax —Axelson; B —Biplane; Bak —Bakelite; Bn —Beam; Bo —Bolted; Box —Box spar; Br —Brownback; Bx —Bendix; C —Closed; Ca —Cable; Can —Cantilever; Cd —Cord; Cg —Corrugated; Ch —Challenger; Cir —Cirrus; Co —Comet; Com —Compression; Con —Continental; Cq —Conqueror; Cs —Shock Cord; Cn —Curtiss; Cv —Conventional; Cy —Cyclone; D —Duralumin; Dep —Deperdussin; Du —Dual; Ex —Extra; F —Flying boat; Fab —Fabric; Fl —Flottorp; G —Glued; Ge —Genet; Gu —Goodyear; Gr —Gross; Gt —Gov't test; Gy —Gipsy; H —Hamilton; Hn —Henderson; Hs —Hispano; Ht —Heat treated; Hw —Hess Warrior; Hyd —Hydraulic; Hn —Hartzell; I —I section; In —Internal; Ir —Irwin; K —Kinner; Kh —Kelsey Hayes; L —Landplane; La-l —Ace; Lam —Lambert; Lb —LeBlond; Li —Liberty; Lk —Lockheed; Lmd —Laminated; Lr —LeRhone; Ly —Lycoming; M —Monoplane; Me —Metal; Mo —Monocoque; Ms —Mfr's Statement; N —New; Na —Navigation; O —Open; Ol —Oleo; Old —Oildraulic; Op —Optional; OX 5 —Curtiss; P —Paragon; Pe —Pedal; Pk —P-K screws; Ply —Plywood; Pn —Pneumatic; Pr —Push Rod; Pwh —P & W Hornet; Pwj —P & W Wasp Jr; Pww —P & W Wasp; Q —Seaquiplane; R —Rubber; Rn —Reed; Ro —Routed; Rus —Russo; Rv —Riveted; S —Steel; Sa —Sackely; Se —Sewed; Sc —Coil Springs; Scd —Screwed; Sd —Stamped; Sh —Sheet; Sk —Stick; Sol —Solid; Sp —Spruce; Spl —Split; Sr —Super Rhone; St —Standard; Str —Straight; Su —Supreme; Sy —Story; Sn —Sackely; T —Tubing; Tr —Trombone; Trsl —Trestle; Trs —Truss; Ta —Tacked and sewn; W —Wood; Wa —Warren Truss; Wnr —Warner; Wn —Westinghouse; Wh —Wheel; Wi —Wire; Wl —Welded; Wr —Wright; Wt —Wind Tunnel; Ww —New Whirlwind; Y —Yankee; Z —Seaplane; * —Without engine

Ace —La-l; Aeral —Aer; Air Wheels —Aw; Alclad —Ad; Amphibian —A; Ansani —Ans; Applied —Apl; Arena —Ar; Axelson —Ax; Axle —Al; Bakelite —Bak; Beam —Bn; Bendix —Bx; Biplane —B; Bolted —Bo; Box Spar —Box; Brownback —Br; Cable —Ca; Cantilever —Can; Challenger —Ch; Cirrus —Cir; Closed —C; Coil Springs —Sc; Comet —Co; Compression —Com; Conqueror —Cq; Continental —Con; Conventional —Cv; Cord —Cd; Corrugated —Cg; Curtiss —Cn; Curtiss —OX 5; Cyclone —Cy; Duralumin —D; Deperdussin —Dep; Dual —Dual; Extra —Ex; Fabric —Fab; Flottorp —Fl; Flying Boat —F; Genet —Ge; Gipsy —Gy; Glued —G; Goodyear —Gu; Gov't Test —Gt; Gross —Gr; Hamilton —H; Hartzell —Hn; Heat Treated —Ht; Henderson —Hn; Hess Warrior —Hw; Hispano —Hs; Hydraulic —Hyd; "I" Section —I; Internal —In; Irwin —Ir; Kinner —K; Kelsey Hayes —Kh; Lambert —Lam; Laminated —Lmd; Landplane —L; Le Blond —Lb; LeRhone —Lr; Liberty —Li; Lockheed —Lk; Lycoming —Ly; Metal —Me; Mfr's Statement —Ms; Monocoque —Mo; Monoplane —M; Navigation —Na; New —N; Oildraulic —Old; Oleo —Ol; Open —O; Optional —Op; Paragon —P; Pedal —Pe; P-K Screws —Pk; Plywood —Ply; Pneumatic —Pn; Push Rod —Pr; P & W Hornet —Pwh; P & W Wasp Jr —Pwj; P & W Wasp —Pww; Reed —Rn; Riveted —Rv; Routed —Ro; Rubber —R; Russo Aero Rings —Rus; Sauseddle —San; Screwed —Scd; Seaplane —Z; Seaquiplane —Q; Sewed —Se; Sheet —Sh; Shock Cord —Cs; Solid —Sol; Split —Spl; Spruce —Sp; Stamped —Sd; Standard —St; Steel —S; Stick —Sk; Story —Sy; Straight —Str; Super Rhone —Sr; Supreme —Su; Sackely —Sa; Tacked and Sewn —Ta; Trestle —Trsl; Trombone —Tr; Truss —Trs; Tubing —T; Walter —Wa; Warner —Wnr; Welded —Wl; Westinghouse —Wn; Wheel —Wh; Whirlwind —Ww; Wire —Wi; Wind Tunnel —Wt; Wood —W; Wright —Wr; Yankee —Y; Without Engine —*

Specifications of American Commercial Airplanes

Including only planes with Approved Type Certificates—*AVIATION* does not assume responsibility for the figures given

Manufacturer	LANDING GEAR							AREA (sq. ft.)						PERFORMANCE						
	Material	Type	Tread	Wheels Type and Size	Brakes	Shock Unit L. G. and Tail	Tail Wheel	Wing	Aileron	Fin	Rudder	Stabilizer	Elevator	High Speed (M P H)	Cruising Speed (M P H)	R P M at Cruising	Stall Speed (M P H)	Climb at Sea Level F P M	Service Ceiling (Ft.)	Performance Basis
Alexander Eaglerock A-2	S	Spl Al	6'	26x 4	Ex	Cs	No	530	42 50	4 25	10 10	25 20	16 26	100	87	1 400	40	814	11,000	Gt
Alexander Eaglerock A-12	S	Spl Al	6'	30x 5	Ex	Cs	No	530	42 56	4 25	10 10	25 76	16 26	120	100	1 750	46	770	12 870	Gt
Alexander Eaglerock A-15	S	Spl Al	6'	30x 5	Ex	Cs	No	530	42 50	4 25	10 10	25 76	16 26	100	83	1 280	80	690	9 600	Gt
American Aeronautical S-56	ST D		64"	Wi 20x 4	No	Cs	No	286	24 2	8 3	7 9	17 0	15 5	85	75	1,670	40	400	5 000	Ms
American Eagle [illegible]	ST	Spl Al			Yes	Ol	No	212						115	100			800	18,000	Ms
American Eagle Phaeton E-540	ST	Spl Al			Yes	Ol	No	235	29 54	6 42	9 02	19 76	18 04	156	111	1,800	57			Ms
American Eagle 202	ST	Spl Al			Yes	Ol	No	255	51 2	5 05	8 95	16 62	15 90	130	112	1,750	30			Ms
Arrow A2-60	ST	Spl Al	6 6	Wi 26x 4	No	Cs	No	105	8 75	2 9	5 8	13 0	10 4	100	85	1,800	50	900	14 000	Ms
Bach 3-CT-8	S	Spl Al	10'	Bx 36x 8	Bx	Ol Cs	Ol B	538	52 32	5 4	11 65	58 6	25 0	157	133		60	1 100	18,500	Ms
Bach 3-CT-9	S	Spl Al	10'	Bx 36x 8	Bx	Ol Cs	Ol R	558	52 52	5 4	11 65	58 6	25 0	182	136	1,650	60	1 580	20 000	Ms
Bellanca Pacemaker	ST	Spl Al		Bx 32x 6	Bx	Ol	Pn	275						145	122	1 750	40	1 000	18,000	Ms
Bellanca CH-300 Seaplane								275						136	110	1 750		650	16,000	Ms
Bellanca Freighter	ST	Spl Al		Bx 52x 6	Bx	Ol	Pn	225						145	122	1 250	40	900	12 800	Ms
Brunner-Winkle Bird Model A	ST				No			266						118	90			700	15 000	Ms
Brunner-Winkle Bird Model B	ST				No			266						110	90			800	18 000	Ms
Buhl CA-8-A	S	Spl Al		Bx 36x 8	Bx	Ol	Yes	462	50 0	5 75	12 85	24 5	24 2	145	120	1 700	45	1,000	18,000	Ms
Buhl CA-8-B	S	Spl Al		Bx 36x 8	Bx	Ol	Yes	462	50 0	5 75	12 85	24 5	24 7	145	120	1,200	45	1 000	18 000	Ms
Buhl CA-6	S	Spl Al		Bx 32x 6	Bx	Ol	Yes	515	27 54	4 97	8 7	18 04	18 68	140	115	1 750	45	900	15 000	Ms
Buhl CA-3-D	S	Spl Al		Bx 30x 5	Bx	Ol	Yes	240	18 9	4 2	8 08	15 58	12 90	130	125	1 750	45	900	15 000	Ms
Cessna DC-6-A	ST	Spl Al	8 6	Bx 30x 5	Bx	Old	Yes	265	17 8	5 5	9 5	22 2	16 2	161	150	1,700	54	1,400	19,000	Ms
Cessna DC-6-B	ST	Spl Al	8 0	Bx 30x 5	Bx	Old	Yes	265	12 8	5 5	9 5	22 2	16 2	148	128	1 760	52	900	17 000	Ms
Command Aire 3-C-3A	ST	Spl Al	80	Aw22x10	Gn		No	505	19 0	2 8	7 2	19 0	10 4	98	85	1,750	50	500	10 000	Ms
Command-Aire 3-C-3B	ST	Spl Al	80	Aw22x10	Gn		No	303	19 0	2 8	7 2	19 0	10 4	98	85	1,800	50			Ms
Command Aire 5-C-3Ch	ST	Spl Al	84	Bx 30x 5	Bx	Cs	No	287	19 0	2 8	7 2	19 0	10 4	120	98	1 800	45			Ms
Command Aire 5-C-5AX	ST	Spl Al	84	Bx 30x 5	Bx	Cs	No	282	19 0	2 8	2 2	19 0	10 4	115	96	1,750	45	800	10 600	Ms
Consolidated Commodore								1,110	10 0		40 2	01 0	54 5							
Courier P-B-1	ST	Spl Al	8 10	Kh 26x 4	Kh	Ol Se	No	200	19 8	6 20	7 42	17 20	15 65	105	85	1 650	45			Ms
Crown Custombilt B3	ST	Spl Al	84	Wi 24x 4	No	Gr	No	256	22 0	3 7	5 65	15 8	10 24	222	80	1 000	35	200	23 000	Gt
Cunningham Hall PT 6	S	Spl Al	94	Bx 32x	Bx	Aer		570	51 0	7 5	15 0	29 5	22 5	155	110		58	1 050	17 500	Ms
Curtiss-Wright Corp.																				
Curtiss Carrier Pigeon	ST	Spl Al			Yes	Ol														
Curtiss Fledgling Ch	ST	Spl Al				Ol														
Curtiss Fledgling K2	ST	Spl Al				Ol														
Curtiss Condor	ST	Tred			Yes	Ol	Yes	1 512	241 4		55 0		47 6		118			920	12 000	Ms
Curtiss Robin OX-5	ST	Spl Al	8 8	26 x4	No	Ol	No	243	22 4	5 4	9 7	25 8	17 4	101	85			400	11 250	Ms
Curtiss Robin R-600	ST	Spl Al	8 0	Bx 30x 5	Bx	Ol	No	254	22 4	5 4	9 7	25 8	17 4	120	101			840	12 700	Ms
Curtiss Robin-J	ST	Spl Al	8 8	Bx 30x 5	Bx	Ol	No	245	22 4	5 4	9 7	25 6	17 4	120	101			840	12 200	Ms
Curtiss Thrush-J	ST	Spl Al	9 8	Bx 30x 5	Bx	Ol	Yes	305	22 8	8 92	15 57	30 2	20 4	120	102		52	850	15 200	Ms
Keystone Air Yacht				36x 8		Hyd		512						130	105			850	15 800	Ms
Keystone Commuter				30x 5		Aer		457						112	87			650	12 000	Ms
Keystone Patrician	ST			44x10	Bx	Aleo		950						144	120			1 000	14 500	
Gipsy Moth 60-GM	ST	Spl Al	5 5	Wi 16x 3	No	B	No	245	22 2	2 28	9 45	13 34	12 9	203	86	2 000	46	600	28 000	Gt
Travel Air A 6000-A	Ht S	Spl Al	108"	Bx 32x 6	Bx	Ol	Yes	340	33 5	6 3	15 5	35 1	21 2	145	118	1 700	67	1 000	[illegible]	Ms
Travel Air 6000-B	Ht S	Spl Al	108	Bx 32x 6	Bx	Ol	Yes	280	30 4	6 3	15 5	35 1	21 2	133	112	1 200	65 8	800	18 800	Ms
Travel Air E 4000	Ht S	Spl Al	78"	Bx 30x 5	Bx	Cs	No	289	19 5	4 5	9 2	18 8	16 8	122	103	1 200	54 7			Ms
Travel Air 4-D	Ht S	Spl Al	84"	Bx 30x 5	Bx	Ol	No	289	19 5	4 5	9 2	21 7	17 1	158	136	1 700	56 7			Ms
Davis D-1	ST	Spl Al	6' 6"	Wi 18x 4	No	Cs	No	145						101	85	1 750	40	700	10 000	Ms
Davis D1-K	ST	Spl Al	6' 6"	Wi 18x 4	No	Cs	No	145						124	105	1 780	45	1 200	12,000	Ms
Detroit Aircraft Corp.																				
Eastman Flying Yacht								244						112	98			1 000	14 000	Ms
Lockheed Air Express	ST	Spl Al						288						185	155			1 500	20 000	Ms
Lockheed Vega Model 5B	ST	Spl Al						275						185	155			1 200	20 000	Ms
Parks P-1	ST	Spl Al	99	Wi 26x 4	No	R	No	290	27 28	4 8	7 2	27 4	16 9	102	90			500	11 000	Ms
Ryan B-5	ST	Spl Al	10'	Bx 32x 6	Bx	Aer	Pn	280	24 4	6 2	9 7	28 0	16 5	138	122	1 700	60	2 000	18 000	Gt
Ryan B-7	ST	Spl Al	10'	Bx 32x 6	Bx	Aer	Pn	260	24 4	6 4	11 1	27 5	17 5	150	120	1 700	60	1 350	20 000	Gt
Doyle O-2	ST	Spl Al			No		No	165												
Fairchild 42	ST	Spl Al	8 0	Bx 32x 6	Bx	Ol	Yes	290	24 8	4 8	11 8	50 0	24 5	150	109	1 700		780	15 500	Ms
Fairchild 71 A	ST	Spl Al	7' 0	Bx 32x 8	Bx	Ol	Yes	552	34 8	4 8	11 6	30 9	24 5	155	110	1 700		875	15 500	Ms
Fairchild KR 31	ST	Spl Al			Yes	BD	No	296						102	80			548	12 000	Ms
Fairchild KR-34A	ST	Spl Al	71	Bx 28x 4	Bx	BD	No	285	36 4	4 8	7 5	20 3	16 9	125	105			800	14 100	Ms
Fairchild KR-21	ST	Spl Al	5 6	Kh 24 x4	No	RC	No	193	17 5	4 4	5 5	12 9	8 8	113	95			775	15 000	Ms
Fleet Model 1	ST	Spl Al			Op	Ol	No	195						111	98			870	15 000	Ms
Fleet Model 2	ST	Spl Al			Op	Ol	No	195						115	98			870	15,000	Ms
Fokker F-10A	ST	Tred	15 8		Yes	Ol, B	Op	850		11 0	28 5	80 0	46 6	160	218	1 650		1,000	28 000	Gt
Fokker Universal	ST	Spl Al	10 2	Bx 32x 8	Yes	R	No	550	22 0	2 21	11 62	23 86	28 8	136	115	1 650		650	14 000	Gt
Fokker F-11A	ST	Spl Al	14 5	Bx 36 x8	Yes	R	No	548	26 0	26 6	15 4	39 0	30 8	132	98	1 600		700		Gt
Fokker F-14	ST	Tred	12' 8	Bx 36x 8	Yes	Ol	Yes	550	28 0	4 69	15 5	55 6	35 6	133	110	1 650		2,000	14 000	Gt
Fokker F-32	ST	Tred	20'	Bx 56x12	Yes	Ol	Yes	1 358	87 6	29 0	39 2	77 8	72 0	140	120	1 650		1,200	18 000	Gt
Fokker Super Universal	ST	Spl Al	10 5	Bx 36x 8	Yes	B	No	370		2 21	11 62	23 86	20 0	138	118	1 600				

A —Amphibian
Ad —Alclad
Aer —Aerol
Al —Axle
Ana —Ansaul
Apl —Applied
Ar —Arena
Aw —Air Wheels
Ax —Axelson
B —Biplane
Bak —Bakelite
Bs —Beam
Bo —Bolted
Bsp —Box spar
Br —Brownback
Bx —Bendix
C —Closed
Can —Cantilever

Ca —Cable
Cd —Cord
Cg —Corrugated
Ch —Challenger
Cir —Cirrus
Co —Comet
Com —Compression
Con —Continental
Cq —Conqueror
Cs —Shock Cord
Cu —Curtiss
Cv —Conventional
Cy —Cyclone
D —Duralumin
Dep —Deperdussin
Du —Dual
Ex —Extra
F —Flying boat

Fab —Fabric
Fl —Flottorp
G —Glued
Ge —Genet
Go —Goodyear
Gr —Gruss
Gt —Gov't test
Gy —Gipsy
H —Hamilton
He —Henderson
His —Hispano
Ht —Heat treated
Hw —Hess Warrior
Hyd —Hydraulic
Hs —Hartzell
I —"I" section
In —Internal
Ir —Irwin

K —Kinner
Kh —Kelsey-Hayes
L —Landplane
La I —Ace
Lam —Lambert
Lb —LeBlond
Ll —Liberty
Lk —Lockheed
Lmd —Laminated
Lr —LeRhone
Ly —Lycoming
M —Monoplane
Mt —Metal
Mo —Monocoque
Ms —Mfr's Statement
N —New
Na —Navigation
O —Open

Ol —Oleo
Old —Oildraulic
Op —Optional
OX-5 —Curtiss
P —Paragon
Pe —Pedal
Pk —P K screws
Ply —Plywood
Pn —Pneumatic
Pr —Push Rod
Pwh —P & W Hornet
Pwj —P & W Wasp Jr
Pww —P & W Wasp
Q —Seaquiplane
R —Rubber
Re —Reed
Ro —Routed
Rus —Rusco

Rv —Riveted
S —Steel
Sa —Sausedde
Se —Sewed
Sc —Coil Springs
Scd —Screwed
Sd —Stamped
Sh —Sheet
Sk —Stick
Sol —Solid
Sp —Spruce
Spl —Split
Sr —Super Rhone
St —Standard
Str —Straight
Su —Supreme
Sy —Story
Sz —Szekely

T —Tubing
Tr —Trombone
Tred —Treadle
Trs —Truss
Ts —Tacked and sewn
W —Wood
Wa —Warren Truss
War —Warner
We —Westinghouse
Wh —Wheel
Wi —Wire
Wl —Welded
Wr —Wright
Wt —Wind Tunnel
Ww —New Whirlwind
Y —Yankee
Z —Seaplane
* —Without engine

Specifications of American Commercial Airplanes

Including only planes with Approved Type Certificates—*AVIATION* does not assume responsibility for the figures given

Manufacturer	LANDING GEAR							AREA (sq. ft.)						PERFORMANCE						
	Material	Type	Tread	Wheels Type and Size	Brakes	Shock Unit L. G. and Tail	Tail Wheel	Wing	Aileron	Fin	Rudder	Stabilizer	Elevator	High Speed (M P H)	Cruising Speed (M P H)	R P M at Cruising	Stall Speed (M P H)	Climb at Sea Level F P M	Service Ceiling (Ft.)	Performance Basis
Ford 4-AT-E	ST	Tred	16 9	D	Own	Hyd	Yes	785						130	107	1,600	52	920	16,500	Ms
Ford 5-AT-C	ST	Tred	18 7	D	Own	Hyd	Yes	855						155	112	1,600	64	1,160	17 500	Ms
Ford 7-AT	ST	Tred	18 7	D	Own	Hyd	Yes	855						154	110	1,600	60	880	14 100	Ms
Ford 5-AT-C-S	ST	Tred	14 9	D	Own	Hyd	Yes	835						150	104	1,600	64	900	14,280	Ms
General Aristocrat	D	Spl Al	7 0	Bx 50x 5	Bx	R Com	Yes	195	19 5	1 82	2 47	11 24	10 12	110	90	1 650	40	850	12 150	Ms
General Aristocrat 102-E	D	Con	7	Bx 50x 5	Bx	R Com	Yes	198	21 2	2 66	7 04	11 24	10 92	125	110	1 670	46			Ms
General Cadet 111-C	D	Can	7	Bx 30x 5	Bx	R Com	Yes	201	19 46	1 82	2 47	11 24	10 92	110	95	1 650	40			Ms
Great Lakes 2T-1A	Ht S	Spl Al	5 10	Wi 24x 4	Bx	Ol & Se	No	188	16 6	3 5	5 7	15 46	9 5	110				545	15 010	Ms
Inland S-300	Wl ST	Spl Al			No	Hyd	No	144						110	90					Ms
Ireland N-2-B	ST	Spl Al	7 10	Bx 32x 6	No	Ol	No	526	53 2	15 62	18 2	29 15	25 8	115	85	1 750	46	650	14 000	Ms
Ireland N-2-C	ST	Spl Al	7 10	Bx 32x 6	No	Ol	No	376	35 2	15 62	18 2	29 15	25 8	120	100	1 750	47	1,000	16 000	Ms
Laird LC-R-300	S	Spl Al			Bx	RCd		202						125	155			1 500	20 000	Ms
Lincoln PT	S	Spl Al	76"	26x4	No	B	No	292	30 5	4 7	8 5	17 5	16 0	105	82			600	11 000	Ms
Lincoln PT-K	S	Spl Al	76"	26x4	No	B	No	292	30 5	4 7	8 5	12 5	16 0	105	85			820	15 500	Ms
Lincoln PT-W	S	Spl Al	76"	26x4	No	B	No	297	30 5	4 7	8 5	17 5	16 0	108	85			870	14 000	Ms
Mercury Chic	ST	Spl Al	6 5½	28x4		Cs	No	102	54 0	6 9	5 8			112	90	1,750	40	900	15 000	Ms
Metal G-2-W					Yes	Aer		560						135	112			510	11 500	Ms
Mohawk Pinto	Ht S	Spl Al	8 5	Bx 24	Bx	Gr	No	145	11 9	5 5	6 7	15 5	11 12	115	95	1 700	42	1,100	18,000	Ms
Mohawk M-1-C	Ht S	Spl Al	8 5	Bx 24	Bx	Gr	No	145	11 9	5 5	6 7	15 5	11 12	115	98	1 200	42	1 100	18,000	Ms
Mono Monoprep	Ht S	Spl Al				Ol Se														
Mono Monoport	Ht S	Spl Al			Bx	Ol Se		133						125	110			1 000	20 000	Ms
Mono Monocoach	Ht S	Spl Al			Bx	Ol Se		222						155	[illegible]			1 200	19 000	Ms
New Standard D-29-A	ST	Spl Al	5 11	26 x4	No	OLSC	No	245	21 5	3 6	9 9	18 5	15 5	95	75	1,600	45		14 800	Ms
New Standard D-25-A	ST	Spl Al	8'	30x 5	Sa	OLSC	No	350	28 0	6 5	11 25	33 2	19 7	110	95		48			Ms
New Standard D-27-A	ST	Spl Al	8'	30x 5	Sa	OLSC	No	350	26 0	6 5	12 25	33 2	19 7	110	95		48			Ms
Nicholas Beazley Barling NB-3	ST	Spl Al	6 9	24x 4	No	RCd	No	160	8 0	3 4	5 2	9 5	9 0	105	87		45	600	15 000	Ms
Nicholas Beazley Barling NB-3N	ST	Spl Al	6 9	24x 4	No	RCd	No	160	8 0	3 4	5 2	9 3	9 0	105	87		45	800	15 000	Ms
Nicholas Beazley Barling NB-3G	ST	Spl Al	6' 0	24x 4	No	RCd	No	160	8 0	3 4	5 2	9 3	9 0	110	95		45	800	17 500	Ms
Paramount Cabinaire 165	ST	Spl Al			Bx	Hyd		509						120	101			850	12 000	Ms
Pheasant H-10	ST	Spl Al	5 0	D 22x 8	No	Cs	No	116	13 0	3 6	3 5	8 0	5 5	111	90	1 725	35	500	12,500	Ms
Pitcairn PA-7	Ht S	Spl Al		Bx 30x 5	Bx	Ol	Yes	244	20 8	4 2	6 2	15 4	12 5	145						Ms
Simplex Red Arrow K-2-S	ST	Spl Al			Op	Hyd		160						125	110			1,000	12,000	Ms
Simplex Red Arrow W-2-S	ST	Spl Al			Op	Hyd		180												
Spartan C-3-165	Ht S	Spl Al	85	Bx 30x 5	Yes	Sr Hyd	Op	291	25 0	5 3	7 81	20 6	15 0	121	100	1 750	47	820	12,000	Ms
Spartan C-3-225	Ht S	Spl Al	83	Bx 30x 5	Yes	Sr Hyd	Op	292	25 0	8 12	7 81	25 8	18 0	135	110	1 250	56	1 260	18 000	Gt
Spartan C-3-166	Ht S	Spl Al	83	Bx 30x 5	Yes	Sr Hyd	Op	291	25 0	5 3	7 81	20 6	15 0	115	92	1 650	47	800	11,000	Ms
Spartan C4-225	ST	Spl Al	10	Bx 32x 6	Yes	Ol Old	Yes	299	18 29	6 9	15 5	15 5	15 5							
Star Cavalier C	ST	Spl Al	61	Wi 26x 4	No		No	142	17 85	3 7	6 5	12 8	8 8	100	90	2 000	50	800	10 000	Ms
Stinson SM-6B	ST	Spl Al	9 8	Bx 36x 8	Yes	Hyd	Yes	334	34 8	9 0	11 7	27 1	22 3	245	220	1,750	80		20,000	Gt
Stinson SM-6B	ST	Spl Al	9 2	30x 5	Yes	Hyd	Yes	254	25 4	5 2	11 6	25 3	18 8	132	210	2,700	60			Gt
Stinson Detroiter	ST	Spl Al	9 8	32x 6	Yes	Hyd	Yes	292	51 0	9 0	11 7	27 1	22 5	150	115	1 750	58			Gt
Stinson SM-8A Jr.	ST	Spl Al	9 7	30x 5	Yes	Hyd	Yes	234	25 4	5 2	11 8	25 5	18 8	128	104	1,200	55			Gt
Stinson SM-7A	ST	Spl Al	9 7	32x 6	Yes	Hyd	Yes	234	25 4	5 2	11 8	23 3	18 8	144	128	1,250	58			Gt
St. Louis Cardinal C-2 110	S	Spl Al	75	Wi 26x 4	Own	Old	No	160	15 0	4 1	4 8	12 5	8 2	125	110	1 900	45	1 100	15 000	Ms
St. Louis Cardinal C-2 90	S	Spl Al	75	Wi 26x 4	Own	Old	No	160	15 0	4 1	4 8	12 5	8 7	118	102	1 800	45	98	13 500	Ms
St. Louis Cardinal C-2 65	S	Spl Al	75	Wi 20x 4	Own	Old	No	160	15 0	4 1	4 8	12.5	8 7	105	90	1 600	42	630	12 000	Ms
Swallow TP	S	Str Al	7	Aw 28x 4	No	R Cd	No	296	28 0	5 5	7 0	16 0	15 0	90	75	1,350		803	15 000	Ms
Swallow F-28-Ax	S	Spl Al	7	30x 5	Op	R Cd	No	300	28 0	5 5	7 5	18 0	14 5	110	95					Ms
Swallow TP-K	S	Str Al	7'	Aw28x 4	No	R Cd	No	296	70 0	5 5	7 3	16 0	15 0	100	85					Ms
Swallow TP-W	S	Str Al	7	Aw26x 4	No	R Cd	No	296	28 0	5 5	7 3	16 0	15 0	100	85	1 780				Ms
Texas Temple	S	Spl Al						225												
United Aircraft & Transport Corp.																				
Boeing 100	S D	Str Al	75	Bx 30x 5	Bx	Ol	No	228	13 8	1 8	8 2	19 9	13 4	165	140	1 800	55			Ms
Boeing 204								473	38 4	14 5	17 1	26 0	28 0	133	110	1,625	60			Ms
Boeing 40 B 4	ST	Str Al	80	Bx 30x 5	Bx	Ol	No	545	38 8	8 4	15 9	43 2	28 3	138	110	1,600	58	800	16 500	Ms
Boeing 80 A	ST	Tred	216	Bx 54x12	Bx	Ol & Se	Ol&Se	1,250	101 0	14 5	26 8	80 6	56 8	138	115	1,600	57	900	15 500	Ms
Hamilton H 45	ST	Spl Al			Yes	Aer	Yes	587						135	115			950	[illegible]	Ms
Hamilton H 47	ST	Spl Al			Yes	Aer	Yes	382						140	120			1 000	16 000	Ms
Sikorsky S-38	ST					Hyd		720						125	110			860	18 000	Ms
Stearman LT-1	ST	Spl Al			Yes	R Hyd		490						154	118			900	15 030	Ms
Stearman C-3-R	ST	Spl Al			Yes	R Hyd		288						155	110			1 000	16,533	Ms
Stearman 4-C	ST	Spl Al			Yes	R Hyd														
Viking Kittyhawk B-2	ST	Spl Al	7 2	26x 4	Op	R Com	No	235	22 3	5 68	8 36	24 04	12 84	110	90			650		Ms
Viking Kittyhawk B-4	ST	Spl Al	7 2	26x 4	Op	R Com	No	253	22 3	5 69	8 50	24 04	12 84	110	90			850		Ms
Waco 90	ST	Spl Al	78	26x 4	Op	Ol Se	No	288	27 6	4 86	7 8	16 1	14 75	96	85			50	15,000	Ms
Waco 165	ST	Spl Al	78	Bx 30x 5	Bx	Aer Gr	No	288	27 0	4 85	7 8	17 3	15 86	120	100			700	18 000	Ms
Waco 225 str. w	ST	Spl Al	78	Bx 30x 5	Bx	Aer Gr	No	288	27 6	4 86	7 8	16 1	14 75	128	105			1 200	19 000	Ms
Waco 225 tap. w	ST	Spl Al	78	Bx 30x 5	Bx	Aer Gr	No	227	18 0	4 86	7 8	10 1	14 75	138	115	1 750	48	1 500	19 000	Ms
Warner Argo	S	Spl Al	6	Bx 26x 5	Yes	R	No	203	20 8	5 8	5 2	12 2	11 7	120	100	1 758	47	850	16 000	Ms

Ace —La I
Aerol —Aer
Air Wheels —Aw
Alclad —Ad
Amphibian —A
Ansaul —Ana
Applied —Apl
Arena —Ar
Axelson —Ax
Axle —Al
Bakelite —Bak
Beam —Bs
Bendix —Bx
Biplane —B
Bolted —Bo
Box Spar —Bsp
Brownback —Br
Cable —Ca

Cantilever —Can
Challenger —Ch
Cirrus —Cir
Closed —C
Coil Springs —Sc
Comet —Co
Compression —Com
Conqueror —Cq
Continental —Con
Conventional —Cv
Cord —Cd
Corrugated —Cg
Curtiss —Cu
Curtiss —OX-5
Cyclone —Cy
Duralumin —D
Deperdussin —Dep
Dual —Dual

Extra —Ex
Fabric —Fab
Flottorp —Fl
Flying Boat —F
Genet —Ge
Gipsy —Gy
Glued —G
Goodyear —Go
Gov't Test —Gt
Gruss —Gr
Hamilton —H
Hartzell —Hs
Heat Treated —Ht
Henderson —He
Hess Warrior —Hw
Hispano —His
Hydraulic —Hyd
"I" Section —I

Internal —In
Irwin —Ir
Kinner —K
Kelsey-Hayes —Kh
Lambert —Lam
Laminated —Lmd
Landplane —L
LeBlond —Lb
LeRhone —Lr
Liberty —Ll
Lockheed —Lk
Lycoming —Ly
Metal —Mt
Mfr's Statement —Ms
Monocoque —Mo
Monoplane —M
Navigation —Na
New —N

Oildraulic —Old
Oleo —Ol
Open —O
Optional —Op
Paragon —P
Pedal —Pe
P-K Screws —Pk
Plywood —Ply
Pneumatic —Pn
Push Rod —Pr
P & W Hornet —Pwh
P & W Wasp Jr —Pwj
P & W Wasp —Pww
Reed —Re
Riveted —Rv
Routed —Ro
Rubber —R
Rusco Aero Rings —Rus

Sausedde —Sau
Screwed —Scd
Seaplane —Z
Seaquiplane —Q
Sewed —Se
Sheet —Sh
Shock Cord —Cs
Solid —Sol
Split —Spl
Spruce —Sp
Stamped —Sd
Standard —St
Steel —S
Stick —Sk
Story —Sy
Straight —Str
Super Rhone —Sr
Supreme —Su

Szekely —Sz
Tacked and Sewn —Ts
Treadle —Tred
Trombone —Tr
Truss —Trs
Tubing —T
Walter —Wa
Warner —War
Welded —Wl
Westinghouse —We
Wheel —Wh
Whirlwind —Ww
Wire —Wi
Wind Tunnel —Wt
Wood —W
Wright —Wr
Yankee —Y
Without Engine —*

Specifications of Airplanes not having Group I Type Certificates

AVIATION does not assume responsibility for the figures given

Manufacturer	Designation	Price at Factory	Type	Number Seats	Power Plant	Total Hp	Span (Ft.)	Wing Area (Sq.Ft.)	Length Overall (Ft.)	Height Overall (Ft.)	Weight Empty (Lb.)	Pay Load (Lb.)	Gross Weight (Lb.)	Normal Range (Miles)	Wing Const.	Fuselage Const.	High Speed (M.P.H.)	Service Ceiling (Ft.)	Type of Control	Brakes	Type of Shock Absorber	Type Certificate Status
Aeronautical Corp. of Am.	Aeronca C 2	$1 880	OML	2	Aeronca E-127	30	36	144	20	7	375	150	700	315	W Fab	Wl-ST	85	16 500			R	Apl
Arrow Aircraft & Motors Corp	A2-100h	5 995	OBL	2	K	90	25 16	183	19 6	8 4	1 084	220	1 550	300	W-Fab	Wl-ST	110	16,000	Sk	No	Ca	H
Bellanca Aircraft Corp	Pacemaker 400	18,700	CML	6	Pww	420	46 8	309	27 10	8 11	2 550	1 170	4 400	700	Sp-Fab	Wl-ST	150	20 000	Sk	Bx	Old	Apl
Bird Wing Commercial Aircraft Co	Imperial No 10		OBL	3	Wr J-6-5	165	51' 4"	304	24' 2	8' 7	1 458	372	2,220		W-Fab	Wl-ST	125	15 000	Sk	Ex		H
Breese Aircraft Corp	B 6	15 000	OML	6	Wr J 6	300	41	260	27	10 6	1 155		2,550	550	W Fab	Wl ST	120	15 500		Bx	Rus	Apl
Chance Vought Corp	Corsair		OBL	2	Pww	420		320	24 7	10' 2	2 300		3 500	660	W Fab	Wl-ST	152	22 000	Du	Bx	Ol	
Chance Vought Corp	Corsair Seaplane	—	OBZ	2	Pww	420		520	28 6	11 4"	2 600		5 000	600	W Fab	Wl-ST	148	22,500	Du			
Curtiss Aeroplane & Motor Co	Kingbird		CML	7 6	Wr J 6	450	54' 6"	405	34 9	10'	3 824		5 824	447	D Fab	ST-Bak-Fab	135	14,700	Wh, Pe			
Heath Airplane Co., Inc.	Parasol	975	OML	1	Heath	27	25'	110	17'	4 6	700		580	270	W Fab	Wl-ST	70	12,500	Sk	No	R	
Irwin Aircraft Co.	F A-1	1 265	OBL	1	Irwin-79	25	20'	105	15 6	5 9	275	75	500	250	W-Fab	W	85	10 000	Sk	No	R	
Metal Aircraft Corp	G 2 H	23 500	CML	8	Pwh	510	59	560	52 10	9 6	5 460	1 440	6 000	580	D	Wl-ST D	140	14 000	Wh	Yes	Aer	
Paramount Aircraft Corp	Cabinaire-110	[illegible]	CBL	4	War	110	33' 2"	309	24	9'	1,552	[illegible]	2,296	465	W-Fab	Wl-ST	103	9000	Sk	Bx	Pe	Apl
Pheasant Aircraft Co., Inc.	Traveler A-1	2 495	CML	1	Oxx	55	51' 6	118	20 6	6 5	570	115	950	510	W-Fab	Wl-ST	106	12 500	Sk	No		
Ryan Aircraft Corp	Foursome C-1	10 990	CMH	4	Wr J 6	225	39' 3"	220	27 7	9 9	2 000	600	3 000	625	S-W Fab	Wl-ST	130	16 000	Sk	Bx	Ol	
Stearman Aircraft Co	C-4-A		CBL	3	Wr J 6	300	38'	506	26 5	10 2	2 230	755	5 800	73	W Fab	Wl ST	143	17 000	Sk	Yes	R Hyd	Apl
Sackety Aircraft & Engine Co	Flying Dutchman	2 000	OML	1	Ss	40	26	100	18'	6 6	551	231	800	360	W-Fab	Wl-ST	90	11 000	Sk	No	Rus	Apl
Taylor Bros. Aircraft Corp	Chummy	4 650	CML	2	K	90	34	163	22 10	7 6	1 052	212	1 646	450	W Fab	Wl-ST	110	15 000	Sk	Op	Ol	
Whittelsey Mfg. Co.	Avian	4 995	OBL	2	Cir	85	28'	254	24	8 6	910		1,460	430	W-Fab	Wl-ST	102	17 000	Sk Pe	No	R	

Canadian

Manufacturer	Designation	Price at Factory	Type	Number Seats	Power Plant	Total Hp	Span (Ft.)	Wing Area (Sq.Ft.)	Length Overall (Ft.)	Height Overall (Ft.)	Weight Empty (Lb.)	Pay Load (Lb.)	Gross Weight (Lb.)	Normal Range (Miles)	Wing Const.	Fuselage Const.	High Speed (M.P.H.)	Service Ceiling (Ft.)	Type of Control	Brakes	Type of Shock Absorber	Type Certificate Status
Curtiss-Reid Aircraft Co. Ltd	Rambler			2	Cy	100	22 5	165	23 11	8	1 010	315	1 500		D Fab	Wl-ST-Fab	102		Du Sk			

See previous pages for key

GENERAL NEWS

HERBERT F POWELL *News Editor*

HIGH POINTS in the NEWS

▶ *Arrangements* "Race horse" starts are announced for speed contests, as the Chicago National Air Race program is drafted

▶ *Litigation* Curtiss Assets Corp. institutes suits against Ford and Waco for alleged infringements of Curtiss patents

▶ *Up in March* Aero exports in March totalled $712,779 in value, thus exceeding February's shipments by more than $250 000

▶ *By 42 to 23* Senate passes Bratton bill calling for full information on every aircraft accident since May 20 1926 to be furnished the Senate by the Secretary of Commerce Vote is 42 to 23, reconsideration asked

▶ *Cut again* Arrow Aircraft & Motors Corp further reduces prices of its planes Three models lowered $250, $431 and $495, respectively

▶ *And now the naval base* House Naval Affairs Committee holds hearings on selection of site for West Coast lighter-than-air Naval base The two favorite locations: Sunnyvale, near San Francisco; Camp Kearney, near San Diego

▶ *Dated* Decide sixth annual Edsel B Ford Reliability Tour will start from Detroit September 11 and end there on September 27

Airports and Airlines

▶ *Jointly* Aero Branch the American Engineering Council and the American Road Builders' Association are to make an extensive study of airport design, construction and operation

▶ *Secretly* Officials of air mail and passenger lines meet with Post Office authorities in first of several conferences to discuss application of Watres bill provisions Secrecy surrounds proceedings

Foreign

▶ *Trans-Atlantic mail* Jean Mermoz, Compagnie Aeropostale pilot flies from St. Louis, Senegal, to Natal Brazil with 308 lb of mail, preparatory to possible regular service

▶ *Bound here* *Graf Zeppelin* arrives at Seville, 23½ hr after leaving Friedrichshafen, on way to South and North America Carries 22 passengers, 42 crew

Pasco Holds Fourth Air Jubilee

PASCO (WASH)—This city's fourth annual air jubilee was held May 15-17 and many spectators were on hand to view the exhibition flying and races Lester Meadows Portland in a Travel Air, won the 15-mi race Hap Rountree Yakima in a Waco placed second and A J Berthold Seattle, in a Stinson Detroiter came in third Tex Rankin, was among the fliers on the aerial maneuver program.

Barstow to Receive Edward S. Evans Prize

WASHINGTON (D. C.)—Jack C Barstow, who recently established an unofficial world's record for glider duration by staying aloft 15 hr 13 min., is to be the recipient of a prize offered by Edward S Evans, honorary president of the National Glider Association, through the N A A

This is the result of action taken at the recent meeting of the National Aeronautic Association Contest Committee which left Mr Evans free to present Mr Barstow with the prize—$2,000 for 10 hr in the air and $100 for each extra hour The N A A was unable to give Jack Barstow the award since his mark was unofficial (He carried no barograph) and was therefore not recognized by the F A I

Another phase of the N.A.A. meeting concerned the presentation of rules and regulations for the National Air Races, to be held in Chicago August 23-September 1 The provisions were found to be incomplete and will have to be re-submitted for approval Maj Luke Christopher, secretary of the N A A. Contest Committee will assist the Chicago authorities in perfecting the race code

Attack Porpoises With Plane Bombs

WASHINGTON (D C)—Airplane bombing has been successfully used in the extermination and dispersing of porpoise schools in the Gulf of St Lawrence A despatch received by the Department of Commerce from Consul Horatio Mooers Quebec states that for approximately $5 000 an airplane with crew and ammunition was secured and many porpoises which each year make heavy inroads upon cod and other valuable fish were killed or scattered.

Chicago Prepares For National Races

To Use "Race Horse" Starts in Speed Events

CHICAGO (ILL)—Speed contests on the program of the National Air Races this year will be featured by the introduction of "race horse" starts as a means of widening the popular appeal of the various events, according to Maj Luke Christopher, secretary of the N A A Contest Committee

Anxiety has been expressed in some quarters since the first rumor that the race management thus intended to inaugurate the system of dropping a single flag for the purpose of starting off all the contestants in each of the racing events, because of the apparent danger of accidents These fears were spiked by Major Christopher who says that he has started as many as 26 planes at one time without trouble He points out that the 320-acre Curtiss Chicago Airport is sufficiently large so that no difficulties should arise from the new start ing system during the race week August 23 to September 1 inclusive

Air Ground Parade Planned

The program for the 1930 affair has not been evolved in its entirety It is believed, however, that the first day will be devoted to an aerial parade made up of fighting squadrons of the Navy a Marine Corps observation group and an Army pursuit squadron, as well as commercial planes A street parade similar to the one held before the start of the races in Cleveland, will be arranged if possible to further attract the attention of the public

As in the past military and naval craft will not compete with commercial planes in any of the events which will be conducted There will be separate contests for each. A fireworks display of some 80 different exhibits both ground and air is to be provided each night with the exception of the time that the Navy dirigible, "*Los Angeles*" is at the field A feature of the display will be the destruction of a village by aerial bombardment

During the time of the races Curtiss Wright Flying Service will "shut up shop" so far as its operations from the field are concerned it has been announced by Maj R W Schroeder vice-president and general manager of that organization and Chicago Air Terminals Inc operator of the port

A large grandstand with a seating capacity of 65 000 persons is to be erected in front of the hangar unit In front of that on the concrete apron

(Concluded on Page 1050)

Hearings on Coast Airship Base Begun

Kearney Preferred by One Board, Sunnyvale by Other

WASHINGTON (D C)—Hearings are now under way here, with some touch of controversy, concerning the selection of the West Coast Naval lighter-than-air base The House Naval Affairs Committee is centering its study on Sunnyvale in the San Francisco area and Camp Kearney near San Diego, the two leading choices for the location of the $5,000,000 station

Bills have been introduced by Representative Swing and Representative Free authorizing the selection of Camp Kearney and Sunnyvale, respectively, thus both hats are in the ring At this writing Adm John Chase, senior member of the General Board of the Navy and Adm H H Hough member of the Board, have testified In the course of events, it is believed all members of the General Board present in Washington will be questioned as to the recommendation by the Board of the Camp Kearney site over the majority selection of Sunnyvale by the special West Coast airship board

Many Locations Considered

Chairman Britten in his questioning of witnesses has sought to tie in the location of the base with the establishment of a naval supply station at San Francisco On the other hand Representative Vinson, ranking majority member has endeavored to restrict the inquiry to the airship base selection Meanwhile Representative McClintic of Oklahoma has demonstrated to the committee by maps the eminent desirability of Oklahoma City as an airship base The fact that the Navy regards the dirigible as a weapon and that as such it should be situated close to the coast line has little daunted the interest of the Oklahoman in his inland site

A total of 97 west coast locations and seven sites in inland states were investigated by the West Coast board before the selection of Sunnyvale and Camp Kearney for the final choice Sunnyvale was preferred by Rear Admiral Moffett head of the Bureau of Aeronautics Commander Fulton Lieutenant Commander Rosendahl and Lieutenant Commander Marshall The fifth member of the board, Admiral Reeves recommended Camp Kearney Admiral Moffett and Commander Rosendahl had favored the selection of Camp Kearney before visiting the West Coast, but they changed their opinions after consideration of meteorological and aerological conditions

The General Board of the Navy, acting upon the material presented it by the West Coast board reversed the recommendation of that board and decided for Camp Kearney "Having regard for all characteristics other than strategic" the General Board states in its report, "the site at Sunnyvale and the site at Camp Kearney are approximately equal and both eminently suitable for an airship base Strategically the General Board considers the site at Camp Kearney superior to the site at Sunnyvale The General Board is further of the opinion that close contact and cooperation with the fleet are essential to the efficient development of airships and that these vital requirements can best be met by establishing the airship base in the Los Angeles-San Diego area"

That the Navy considers the airship as an experimental weapon was made clear by the officers questioned Emphasis was placed upon the necessity of having the dirigible base in close proximity to the fleet while the airship is going through its developmental stages At present the Navy believes the greatest value of the airship will be in long scouting trips at more than 3,000 mi For these reasons Camp Kearney is particularly favored, as the fleet operates near San Diego or San Pedro 65 per cent of the time and as Camp Kearney is close to the center of a strategic area of the greatest importance which may be drawn roughly as a triangle whose apex rests on Puget Sound and whose points touch the Canal Zone and the Hawaiian Islands Ability of the naval heavier-than-air base in the neighborhood at Camp Kearney, at North Island to defend the airship hangar in case of attack from the air was another point in favor of the selection of the Camp Kearney site The Navy has no aeronautical activities in the vicinity of Sunnyvale Admiral Chase on questioning as to the chance of danger to the hangar from the fire of enemy long range guns from the sea replied that after a lifetime in ordnance he was willing to take that chance

Alliance Holdings to be Sold

ALLIANCE (OHIO) — Factory and equipment of the Alliance Aircraft Corp is to be offered at a receiver's sale scheduled for June 5 A court order for the sale has been issued by Judge Henry W Harter Jr of Canton at the request of Robert Purcell of Alliance receiver of the company to clear up all legal entanglements hindering resumption of activities at the plant by the Warner Aeronautical Corp W E Davis, G W Shem and N N Scovill, appraisers have placed the physical value of the plant and equipment at $159,000

Approve Stearman and Menasco

WASHINGTON (D C) — Approved type certificate No 322 has been awarded a Stearman 4FM a one-place open biplane Wasp powered weighing 2,445 lb empty and 3,936 lb gross with a useful load of 1,481 lb The Menasco Pirate A-4 a 4-cyl inline air-cooled inverted power plant developing 90 hp at 1,925 r p m has been given approved type engine certificate No 50

Chicago Now Prepares For National Races

(Concluded from page 1049)

paddocks will be constructed where the contesting planes will be displayed before the start of each race, so that the spectators will have a better opportunity of observing them

The interior of the hangar unit will not be used to house the competing craft They will be staked down in the open as usual A portion of the large space that is available under cover is to be turned into a cafeteria The remainder of it, with the exception of that devoted to storing the equipment for the fireworks displays, may be used as an exhibition hall It has not been definitely decided, but it is probable that all manufacturers entering planes in the races will be allowed to exhibit similar craft inside the hangar

The south or student training, field of Curtiss-Chicago Airport will be utilized while the races are in progress for the parking of automobiles It is estimated that 10,000 cars can be parked on this 130-acre tract Besides this, 116 acres of land adjoining the 320-acre commercial field to the west and north have been leased so that there will be large parking areas on three sides of the port The space within the wire fence enclosure behind the hangar unit is to be reserved for the automobiles of officials and box holders

Draft Traffic System

One-way traffic is planned on all roads leading to and from the field during certain periods of the day According to the plan, traffic from the north will be diverted at Northbrook into Shemer Road which bounds the airport to the west Traffic from the city will be divided between Shemer and Waukegan Roads Those coming in from the west will take Lake Avenue which runs between the north and south fields By means of this system the air race management hopes to make it possible to travel from the "loop" district of the city to the airport in an hour

To accommodate those who do not care to make use of their automobiles spur tracks may be laid from the main line of the Chicago, Milwaukee, St Paul and Pacific Railroad which bounds the airport on the east along the northern boundary of the field The southeast corner of the port is to be used as a landing area for transport planes and amphibions which will undoubtedly be operated in shuttle service from the lake front near the business section of the city and from the Municipal Airport

Bellanca to Try Bristol-Jupiters

NEW CASTLE (DEL.)—Bellanca Aircraft Corp is to take delivery on two special high-compression supercharged 550 hp Bristol Jupiter engines for use in experimental flights It is not stated however in which Bellanca machines they will be employed.

For Fast Mail Service—The Model 20 Fleetster

DIFFERING FROM the original Model 17 Fleetster in that it is built primarily for mail and express carriage, the new Hornet-powered Model 20 Fleetster, shown above, is the first of this parasol type to be used by the New York Rio & Buenos Aires Line on its South American mail routes

In this machine, the passenger cabin is replaced by a mail compartment, while the pilot's cockpit has been moved aft and the wings raised 12 in. above the fuselage to give added forward visibility The Consolidated Aircraft Corp, builder, announces a weight empty of 3,150 lb and a useful load of 2,750 lb, giving a gross weight of 5,900 lb. Pay load is set at 1,870 lb

Second Nebraska Tour To be Held June 23-28

LINCOLN (NEB)—Plans were drafted here recently for the second Nebraska air tour, to be held the week of June 23 and to start from Lincoln Max Kier, president of the local N A A chapter, is in charge of arrangements for the tour which is being sponsored by N A A branches throughout the state

Thirty odd craft and approximately 100 men from Omaha Lincoln, and Falls City are expected to participate in the tour If landing facilities permit most of the large Nebraska cities will be visited before the trip ends at Omaha, June 28 Among the cities which have asked to be made day-and-night stops are Falls City Scottsbluff and Norfolk.

Harry B Sidles, Jr., president and general manager of the Sidles Aircraft Corp. Lincoln, has been chosen general tour chairman On his committee are Joe Lewis, president of Mid-West Aviation Corp, Omaha, Eric Rogers, Omaha, and Dee Eiche, Lincoln

Plan R-100 Reception

MONTREAL (QUE)—At this writing the exact date of the R 100's departure from England has not been decided upon according to authorities here though the start is expected about the 25th Tentative arrangements, however, have been drafted for the reception of the dirigible which, it is stated, will remain in Canada for fourteen days Flights over Quebec City, Ottawa and Western Ontario are planned, with St Hubert Airport, Montreal as a base

Storms Delay A.S.M.E. Delegates

DAYTON (OHIO)—Seventy-five were registered here Monday morning, May 19 for the start of the Fourth National Aeronautic Meeting of the Aeronautic Division, American Society of Mechanical Engineers Stormy weather delayed many coming by air and highway, preventing them from attendance at initial sessions

Increase Bowles Meet Prizes

SPRINGFIELD (MASS)—A total of over $10,000 is now offered in cash and trophy awards for the air race meet to be held during the dedication of Bowles Airport on May 31 and June 1, for which twenty events are scheduled A recently added feature is a race for cabin stock model planes of 975 cu in displacement, with prizes totaling $1,000 It is expected the entry list will total 150 planes by May 25th The meet will be ushered in by a model airplane contest in which 250 boy champions from 25 New England cities and towns will compete A permanent grandstand seating 10,000 has been erected on the field and accommodations provided for parking 15,000 automobiles

Report Dominion Imports

OTTAWA (ONT)—Imports of aircraft into Canada during 1929 amounted in value to $2,388,700, of which $1,568,000 came from the United States and $733,500 from Great Britain Aircraft engines to the value of $891,200 were imported

Aero Officials Want Pilot Licenses Altered

NEW YORK (N Y)—Changes in the licensing and examining of pilots have been proposed to the Department of Commerce for incorporation in federal regulations following a meeting of plane manufacturers, airline operators, flying school operators, and others interested in the subject The conference was held here at the Park Central Hotel

Among the modifications described are the following (1) A private pilot should not be allowed to carry passengers until 50 hr of solo flying are completed To compensate for such a drastic ruling, preliminary licenses for solo flying after 5 hr flight would be granted before the private examinations (2) A limited commercial license should not be granted until 75 hr solo had been accumulated, or 50 hr if 80 per cent of that time had been dual instruction (3) Requirements for a transport license should be increased from 200 hr of flying to 275 hr as well as include a thorough knowledge of air traffic law, advanced meteorology aerodynamic theories, etc

Favor Added Private Time

It was also suggested that inspectors putting students through examinations lay more stress on simulated forced landings and spot landings and less on acrobatics righting planes in spins, and such maneuvers

The opinion was set forth that a capable flier need not be an expert mechanic, familiarity with the instrument board and with the basics of flying being the most important considerations In this case, a pilot was compared to the average motor car driver who though he be quite qualified to operate his car, knows little about the engine and its parts

In view of the fact that many taking up private flying courses are business people who have little spare time, those attending the conference deemed it wise to have the length of time allowed for completion of a private course changed from a four month maximum to one year

Another recommendation proposed would give local inspectors a freer rein in suspending licenses for the infraction of air traffic rules, hazardous flying, and carrying persons without credentials

Among Those Present—

The following were among those who attended the meeting G G Budwig, director of Air Regulation, the Department of Commerce, J F Marriott, Chief of Inspection Section Department of Commerce, Capt John O Donaldson, Newark Air Service Oliver Parks, president Parks Air College, St Louis, Charles S ("Casey") Jones, president Curtiss-Wright Flying Service, S L Willitts, president Spartan Flying Service, Tulsa Okla ; Maj Robert L Copsey, manager Newark Air Service and former Department of Commerce inspector, Russell Holderman, president D W Flying Service, Leroy, N Y

Ontario Air Service Develops Monel Tank

ONTARIO (CAN)—After six years of experimental work the Provincial Air Service of the Ontario government, Forestry Branch, has developed gasoline tanks of monel metal—a rustless nickel copper alloy. They have been adopted by that unit as standard equipment on its entire fleet of light seaplanes.

Because of the strength of monel metal, which is greater than that of mild steel, it was decided to try thin sheets of .025 gauge. This offered the advantage of light weights in addition to high corrosive resistance and since it is easily welded presented few fabrication difficulties.

A sample tank built of monel metal in the Sault Ste Marie (Ontario) shops was installed on a plane for tests under actual operating conditions. After careful study of this fuel carrier and further experiments monel metal tanks were selected as standard equipment.

The tank, fitted to a skeleton frame center section which acts as a lifting surface, is internally braced with two transverse bulkheads and has a capacity of 23 Imperial gal (27.6 U. S. gal.).

Prudden-Whitehead Low-Wing Demonstrated

THIS IS THE SECOND all metal plane to be produced by the Atlanta Aircraft Corp, Atlanta Ga, with which are identified George H. Prudden and Edward Whitehead. The craft is an eight-place tri-engined cabin low-wing employing Wright Whirlwind J6-7 power plants. With Eddie Hamilton at the controls Mr. Whitehead and Charles d'Arducss, who has been named foreign representative, recently flew in the plane to Washington D. C. and New York City for the purpose of demonstrating the machine. Our photograph shows the plane at Roosevelt Field N. Y. Note the cowling construction and the way in which the engine nacelles have been faired into the wings of the craft.

Louisiana Aero Bills Ready

NEW ORLEANS (LA)—Two acts having to do with aviation in this state and recently approved by the Louisiana Chamber of Commerce are to shortly be presented to the state legislature. The first bill carries flying regulations based on the Department of Commerce code and would require all operators and planes to be federally licensed. A careful study of Louisiana's aeronautical needs and the establishment and maintenance of emergency landing fields is asked for in the second bill. The Highway Commission would undertake this work assisted by an Advisory Board of four members, two being fliers.

Arrow Plane Prices Cut Again

LINCOLN (NEB)—Still further reductions are announced by the Arrow Aircraft & Motors Corp, which cut the price of its planes several weeks ago. The former and new prices are now as follows: Kinner Arrow Sport Pursuit, $3,995 to $3,500, Lambert Arrow Sport Ninety, $3,500 to $3,250; LeBlond Arrow Sport Trainer $3 131 to $2 700. Increased buying power on raw materials, engines and accessories and economies effected have made this second reduction possible, states general manager Milton Barratt.

To Name ZRS-4 "Akron"

AKRON (OHIO)—"Akron" will be the name of the Navy airship ZRS-4 now being built here by the Goodyear-Zeppelin Corp, according to officials of the Navy Department.

Bellanca to Open N. Y. Office

NEW CASTLE (DEL)—Bellanca Aircraft Corp is to open a metropolitan sales office in the Chrysler Building, 405 Lexington Ave, New York City. R. B. C. Noorduyn, lately named a vice president, will be in charge.

Mich. Ports and Managers Licensed

LANSING (MICH)—In accordance with the State Air Code of the Michigan Board of Aeronautics, airport managers on approved fields must be licensed. About 50 airports have received temporary licenses and 28 of these have received permanent licenses, with an equivalent number of managers likewise commissioned. The ports permanently approved and at which the licensed managers are in charge are:

Detroit City, Ford, Grosse Ile, Triangle Field, Plymouth, National Airways, Detroit, John D. Detroit, Grattot, Royal Oak Field, Pontiac, Ypsilanti, Ann Arbor, Grand Rapids, Muskegon, Owosso Airport, Kalamazoo, Battle Creek, Jackson, Bay City, Saginaw, Emmet County, Saginaw, Alma, Sharon, New Berry, Manistique, Iron Mountain Ford, Menominee County, Blaney and St. Ignace Airport.

Navy Orders Elgin Aero Clocks

ELGIN (ILL)—Elgin National Watch Co announces receipt of an order from the U S Navy Bureau of Aeronautics for 200 aircraft clocks, contracted for by Henry G. Boynton eastern representative of the Elgin aircraft division. These clocks will be furnished in the new Elgin one-piece phenolic composition case recently put through tests by the Navy. Delivery is now being made of 1,100 tachometers recently ordered by the Army Air Corps.

Aero Branch Rules On Danger Zone Flying

WASHINGTON (D C)—In connection with the recent announcement of the Department of Commerce pertaining to flying over high explosive danger areas certified as air space reservations, an amendment to the Air Commerce Regulations has been promulgated by Col Clarence M. Young. It restricts operation over such districts to a minimum altitude of 1,000 ft. The ruling reads:

"Exclusive of taking off from or landing on an established landing field airport or on property designated for that purpose by the owner and except as otherwise permitted by Section 79 aircraft shall not be flown:

"(3) Over Certified High Explosive Danger Areas except at a height sufficient to permit of a reasonably safe emergency landing outside of the certified danger area which in no case shall be less than one thousand (1,000) feet."

Fire Destroys Davis Planes

RICHMOND (IND)—A number of Davis planes awaiting delivery were destroyed in one of the Davis Aircraft Corp storehouses here on May 12 by a fire of unknown origin. Capt. Walter C. Davis, president, had the following to say about the loss: 'The fire which occurred in one of the storage buildings of the Davis Aircraft Corp destroyed a few airplanes which were completed and awaiting delivery, and a small stock of miscellaneous repair parts. The main factory building was not damaged and production has not been interfered with in any manner. The loss was practically covered by insurance.'

STATISTICAL DATA

NEW material further supplementing the statistical issue, AVIATION, March 22, 1930, is given herewith. As announced in our April 26 number (which carried the first supplement) such data will appear regularly in the third issue of each month for the use of those who wish to keep the curves and totals up to date. Page numbers in the statistical issue are given to facilitate reference.

LICENSING

(Page 560) Periodic Airplane License and Identification Data April 30 1930

Licenses Valid	6 604
Identifications Valid	2 943
Ratio of Licenses to Total	0 611

(Page 561) Periodical Record of Pilots and Mechanics Licenses April 30 1930

No of Pilots Licenses Valid	11 914
No of Mechanics Licenses Valid	8,408

(Page 561) Relations of Licensed and Identified Planes, Pilots and Mechanics, April 30 1930

Ratio of Licensed Pilots to Total Planes	1 237
Ratio of Licensed Mechanics to Total Planes	881

AIR TRANSPORTATION AND MAIL

(Page 574) Airway and Operation Mileage as of April 30 1930

Miles of Mail Airways	27 667
Total Miles of Airways	45 622
Airplane Miles Scheduled Daily with Mails	50 433
Total Airplane Miles Scheduled Daily	96 430

(Pages 575-6-7) At the bottom of the page are given March air mail statistics. Cumulative figures for 1930 air mail data for the first quarter of the year are as follows

Total Miles Scheduled	3 891 147
Total Miles Flown	3 450 916
Lb Mail Carried	1 700 922
Amount paid to Contractors	$3 333 867
Average Weight per Scheduled Trip	267 3
Average Compensation per Mile Flown	$0 965
Average Compensation per Lb Carried	$1 959

(Page 578) Percentage of Total Route Mileage on which Mail is Carried

April 30 1930	60 6

(Page 576) Contract Air Mail

Regularity (Percentage of Mileage Flown of Mileage Scheduled)

March	92 83

AIRPORTS

(Page 582) Airport Statement as of April 1 1930

Municipal Airports	470
Commercial Airports	515
Intermediate Fields	293
Government Fields (Army Navy etc)	85
Auxiliary Fields	218
Total number of Airports	1,571

EXPORTS

(Pages 594-5-6) March Export Data were Published in the May 3 Issue Page 915. Cumulative Totals for the First Quarter of the Year are as Follows

No of aircraft	59
Value of Aircraft	$955 533
No of Engines	56
Value of Engines	$250 419
Value of Parts	522 845

CANADIAN AVIATION

(Page 392) The Following will Completely Fill in the Blank Spaces Under 1929 Operations in Canada

Commercial Operations

Airplane Mileage	4 083 321
Seaplane Mileage	1 769 738
Amphibian Mileage	5 956

Licenses and Certificates

Licensed Airplanes	283
Licensed Seaplanes	119
Licensed Flying Boats	37
Licensed Amphibians	6

The Total Licensed Aircraft as Given on Page 392 statistical issue was an Estimated Total. The Correct Total is 445 Planes Licensed in Canada as of January 1 1930.

FOREIGN AERONAUTICAL ACTIVITIES

(Page 604) Statistics of Civil Air Transport for Persia 1929

Passengers Carried (regular service)	3 769
Lb of Mail and Express Carried (regular service)	516 921
Miles of Airlines in Operation	1 095

Franklin Plans New Gliders

ANN ARBOR (MICH)—Production of primary and secondary gliders is planned by the Franklin Company, this city, builder of the glider Eaglet in which Capt Frank M. Hawks was towed across the continent. W. T. Backus, an aircraft dealer located at Parks Air College, East St. Louis, Ill., has been appointed a distributor.

AC Adds to Factory Space

FLINT (MICH)—With the addition of 73,000 sq ft of floor space through a new wing to the plant, AC Spark Plug Co now has a total of 805 000 sq ft. Manufacture of gasoline gages and mica insulated spark plugs for aircraft will take place in the old part of the factory following removal of the engineering department to a location in the new wing.

California, New York Lead in Licensed Craft

WASHINGTON (D C)—A study just completed by the Aeronautics Branch shows that California and New York lead the nation in the number of licensed pilots, planes, and mechanics.

California stands first on the list of licensed pilots and mechanics with 2,244 and 1,582, respectively, while New York heads the list of licensed airplanes with 984.

New York ranks second on the list of licensed pilots and mechanics with 1,153 and 810, respectively, while California occupies second place on the list of licensed planes with 886.

Third place for licensed pilots, planes and mechanics goes to Illinois with 671 pilots, 473 planes, and 505 mechanics.

Texas is fourth in the number of licensed pilots and mechanics with 640 and 462 (it has 267 licensed planes), and Ohio is in the same position on the list of licensed aircraft with 395. (Ohio has 596 licensed pilots and 455 licensed mechanics which entitles it to fifth place in those lists).

There are now nearly 12 000 licensed pilots, 8,500 licensed mechanics, and more than 6 600 licensed airplanes in the United States. Of the total number of licensed pilots, nearly 200 are women. Four women are licensed mechanics.

W. & E. Offers Course With Planes

BUFFALO (N. Y)—Free flight instruction will be given to all purchasers of aircraft by Wright & Essenwein, distributor for the Curtiss-Wright line.

Air Mail Statistical Report for March, 1930

Route Number and Terminal	Length of Route Mi	Frequency (Rd Trips per Month Scheduled)	Miles of Service Scheduled	Miles of Service Actually Flown	Total Weight of Mails Dispatched (Lbs.)	Amount Paid to Contractor
1 Boston-New York	192	90	11 858	9,522	9,465	$28 396.90
2. Chicago-St Louis	278	82	34 472	20,304	4,188	16,907.14
3. Chicago-Dallas	1,050	62	121 314	115,987	35,481	107,553.90
4 Salt Lake City-Los Angeles	600	51	18,900	90,364	11,208	213,023 96
5. Salt Lake City-Pasco	530	62	66 750	63 341	22 063	66 609 66
8 Seattle-Los Angeles	(a)1,141	31	66,041	64,806	26,396	57,513 63
9. Chicago-Minneapolis	(b) 604	48	85,718	74,114	20,581	66,648.28
11 Cleveland-Pittsburgh	123	62	15,108	12,412	4,861	13,072.13
12. Cheyenne-Pueblo	180	31	13,823	10 641	6,678	5 450.05
16. Cleveland-Louisville	315	31	23,002	18,693	5 446	8,644 13
17 New York-Chicago	718	62	111,686	101,944	131 204	199 566.70
18 Chicago-San Francisco	1,932	62	243 061	232,081	106 865	318,318.48
19 New York-Atlanta	763	31	58 851	54 164	34,016	104 418 81
20 Albany-Cleveland	448	36	23 102	18 706	4 636	3,145 15
21 Dallas-Galveston	320	31	19 840	18,424	3,418	8,853 82
22 Dallas-Brownsville	539	31	33 048	32 032	1 018	22 010 02
23 Atlanta-New Orleans	488	31	30 018	29,218	5,202	14 510 23
24 Chicago-Cincinnati	218	62	34 830	25 833	6,348	1,121 28
25 Atlanta-Miami	754	31	46,148	13 000	13,843	20 191 22
26 Great Falls-Salt Lake City	480	31	30,813	30,510	4 528	11 705.98
27 Bay City-Chicago	773	26	47 065	48,442	14,998	13 211 72
28. St Louis-Omaha	404	62	56 214	48 120	13,512	10,586 12
29. New Orleans-Houston	318	31	20 018	20,018	4,155	1,155.12
30. Chicago-Atlanta	768	31	11,018	44,611	8,060	8,634 07
32 Pasco-Seattle	449	31	33 355	32 660	13,650	1,298 51
	14 548	1,096	1,350,250	1,250,968	635,114	$1,271,905.95

(a) Southbound trip not operated between Seattle and Portland.

(b) Service to Elgin, Rockford and Janesville, Wis, and Rochester, Minn, inaugurated March 8, 1930.

Supplemental Payments: Route 8, Dec 1929, 20 lb 3 oz, $82 00, Route 8, Jan 1930, 407 lb 4 oz, $1 131 68; Route 30, Oct 1929 6 lb 2 oz, $4 18.

NOTE—Close comparisons between the various air mail reports issued from time to time will reveal slight discrepancies in various figures. These are not errors, strictly speaking, but are due to various readjustments which have to be made from month to month after the preliminary figures have been released.

AERONAUTICAL FINANCE

By R R Doane

NOW THAT the current year is well under way with the stock market seemingly adjusting itself to a level more in accord with actual conditions it becomes interesting to apply the price-earnings ratio test to the current market quotations of aviation stocks

The prophesied increase in earning power of some of these corporations has not as yet come to pass. Although from a study of their earnings per share in relation to current market prices it must be clear that faith in the original accuracy of an accelerated earning power has not yet undergone any considerable change

Obviously in these days of rapid change in the fortunes and status of individual companies it means very little as to the inherent values that a given stock has advanced or declined by so many points What we must and can, know is the relation of these movements to changes in earning power. It is for this reason that the price-earnings ratio, or market price divided by earnings per share has become a valuable device in recent years

The difficulty in employing such a ratio is to determine *what earnings* to take as a basis of comparison—whether or not we should use the definitely known earnings of the past year or the estimated earnings for the current year And if it is the future estimated earnings which is of course what everyone has in mind what then, shall be the basis of our calculations?

For many years prior to 1928 ten times the annual earnings had been the ready method of estimating a fair selling price for industrial stocks From 1928 on to October, 1929, this ratio mounted to 19 and 20 times earnings Since last autumn the old ratio has once more become the rule Eliminating stock split-ups purchase rights etc, it is well to remember that the normal fluctuation from nine to fifteen times earnings is a fairly safe guide and that the safety of a much higher ratio has never yet been thoroughly demonstrated

Table 2 lists some current variations in this ratio as based upon recent past earnings of the companies.

Let us now suppose these prices to be based entirely upon future net earnings with the full realization that the aircraft industry has especially in that class of industries which represent new types of demand which are characterized by an initial very rapid growth We must still consider past and present earnings in order to obtain the rate of change We must consider the quality background and durability of management, though the principles of managerial efficiency may be more widespread than heretofore And we must still weigh the possibilities of setbacks, depressions obsolescence and unbalanced production in a new and rapidly forming industry

In determining the probable rates of profit, which is all that any estimate of net earnings can ever be, it is well to remember that this is ordinarily figured in terms of a percentage of the gross business less the new money required per dollar of increase to obtain it And it also may be said that that corporation, in any industry that can earn 15 per cent net on added money is certainly doing an exceptional job and a 10 or 12 per cent figure is more to be expected even for the most successful and progressive concerns

At least one authority has set up a highly rational formula for the present valuation of common shares This method involves first the setting up of the best estimates that can be made for a five or ten year period of the growth of the industry, its earnings, its direct and indirect distributions to share holders and its probable new capital requirements. With these factors reasonably determined, the problem becomes simply that of discounting the future disbursements by and payments to the company in question and the future sale value of the shares (plus their increase by stock splits, if any) to present-day value

In general according to all comprehensive researches it has been found that the application of this method leads to values of common shares which rarely, if ever exceeds twenty times their current earnings and far more often falls nearer the traditional ratio of ten times earnings

For purposes of illustration we will take the Curtiss Wright Corp which did approximately 25 per cent of the gross volume of the total aircraft business for 1929 Of this gross the corporation was able to realize 15 per cent net out of which it deducted some two and one-half million dollars for meeting additional capital expenditures Now in the event the total gross volume for the entire industry should progress at its normal rate of 34 per cent for 1930 the total gross for the industry should stand on December 31 at near 131 million. Should the Curtiss Wright Corp retain its quarter share of this total and be able also to maintain its 15 per cent net earnings then 1930 should normally show, for this corporation, net earnings per share of about 80 cents On the other hand, in the event of this corporation being able to secure for itself one-half of the entire industry's gross during 1930 and maintain its same percentage of net it would then be able to show earnings of 1 57 per share and should the market remain buoyant on a twenty times earnings basis this corporation's stock would then be selling at approximately its original offering price of $30

Company	Dividend Rate	Earnings per Share	Current Price	Price-Earnings Ratio
Bendix Aviation	50	3 54	40⅜	11 4
Consolidated Aircraft		1 64	20⅝	12 6
Douglas Aircraft	75	1 19	20⅜	17 1
Irving Air Chute	1 50	2 13	23	10 8
National Aviation		1 03	16⅝	16 1
National Air Transport		1 03	23⅞	23 8
United Aircraft & Trans		4 52	71⅞	15 8
Western Air Express	60	7 15	39⅜	5 5

Table 2

On a normal basis without allowing for increased capital expenditures, increased competition, obsolescence of equipment etc, the summary shown in table 1 may prove helpful in illustrating this method of estimating the probable future value of this corporation's common stock

The principal usefulness of the above method lies in its ability to indicate both the maximum and minimum limits of possible value Such calculations are of course, to be employed as a guide and not as a substitute for good judgment Within these limits, once calculated the investor can apply his personal judgment and knowledge of the company's prospects to determine the price at which he deems purchases may be justified

Years	Estimated Normal Gross for Industry (in Millions)	Maintenance of Corporation's Position	Normal Net	Earnings per Sh Present Number	—Estimated Future Market Price— 10 Times Earnings	15 Times Earnings	20 Times Earnings
1930	131	33	4 95	80	8	12	16
1931	175	44	6 60	1 06	10 60	15 90	21 20
1932	234	57	8 55	1 38	13 80	20 78	27 60
1933	313	78	11 70	1 89	18 90	28 35	37 80
1934	419	105	15 75	2 54	25 40	38 10	50 80

Table 1

United Makes Quarterly Report

United Aircraft & Transport Corp has announced for the quarter ending March 31 1930, net income of $900 391 41, available for dividends after all charges including Federal taxes and deduction for minority interests. This indicates a decrease from the final quarter of 1929 and is below the average rate for that year Profits of National Air Transport, recently acquired are not included

According to the company's report this decrease in earnings was due in

part to a falling off in commercial demand and complete removal into new plants of certain of the important manufacturing subsidiaries, including the Pratt & Whitney Aircraft Co, and Chance Vought Corp at East Hartford Conn and the Hamilton Standard Propeller Corp at Pittsburgh All of the above three companies are large factors in United earnings

The export business of United equipment companies has shown an improvement in 1930 over the previous period. Export shipments totaled $312 832 during the first quarter At the close of April unfinished orders for export amounted to $1,218,230

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Approve Aviation Consolidation

Sale of the Aviation Corporation of Calif and aeronautical holding company to North American Aviation, Inc. has been approved by stockholders The California company received 100 000 shares of North American affording an exchange on a share-for-share basis

From a $5 944 75 deficit at the beginning of the first quarter of 1930 the Aviation Corporation of Calif improved its status, as of March 31, to the point where the deficit was erased and earned surplus increased by $6 491 61

• • •

Ex-Cell-O 1929 Earnings

Combined net income of the Ex-Cell O Aircraft & Tool Corp, and its recent acquisition, the Airparts & Tool Corp for 1929, after deducting all charges including Federal taxes, was $719 509 or $2 12 a share on 339 450 shares of common stock outstanding This is an increase of 80 per cent over 1928 income

• • •

Added Share Listing for United

The listing of 181 567 shares of United Aircraft & Transport Corp common stock that are to be issued in exchange for the outstanding common stock of National Air Transport on the basis of one share for three has been approved by the New York Stock Exchange At the closing prices May 14 of 73⅜ United Aircraft paid an equivalent of $12,300,000 to acquire N A T

The Exchange also approved the listing of 40,000 additional shares of United Aircraft stock that are to be sold from time to time at not less than $75 a share and are to be used for general corporate purposes The application for listing stated that of the 40 000 shares, 10,000 had already been sold at $80 per share

• • •

Stock Averages Show Gain

Aviation stock averages moved from 24 66 (May 9) to 24 81 for the week ending Friday, May 16 a slight increase with total volume remaining substantially the same as during the previous week

Use Plane to Patrol Power Lines

DETROIT (MICH)—The use of airplanes as a mode of travel in patrolling its overhead power lines has been tried by the Detroit Edison Co and found highly satisfactory, according to E L Beach, an official of the company. In experiments to date Mr Beach said, a Curtiss Robin carrying two observers has been flown about 75 ft above and to the side of the line at which height faulty installation can be detected

Boys Shun Autos, Radio, for Aviation

OAKLAND (CALIF)—Apparently, high school boys become intensely interested in one of the new subjects of our growing civilization each ten years; and with each new subject, 10 per cent more boys become so interested

Such a conclusion is reached by the Boeing School of Aeronautics, this city which has compiled statistics to show that 20 yr ago 40 per cent of the high school boys were interested in the automotive industry, 10 yr ago 50 per cent were attracted by radio, and today 60 per cent by aeronautics

In 1940 70 per cent of the high school boys will be interested in—well, what will it be?

Name Junkers Agents in Canada

VANCOUVER (CAN)—Junkers aircraft are now being handled in the Provinces of British Columbia and Alberta by an agency in charge of W A Joerss and Leonard Miller, 1411 Dominion Bank Building, Vancouver The head office of Junkers in Canada is located at Montreal where Richard Beier, Asconia House, 1433 Bishop St, is manager

Argentina Ordees Six Fleets

BUFFALO (N Y)—Six standard Model 2 Fleet planes and spare parts have been ordered from the Consolidated Aircraft Corp by the Director of Civil Aeronautics, Argentina Government Delivery of this $40 000 consignment—the second order for Fleets received from the Argentina authorities—will take place at Buenos Aires by June 1

First Buckley Unit in Operation

WICHITA (KAN)—Fourteen men are now working in the first completed unit of the Buckley Aircraft Co factory being constructed here

Several More Glider Clubs Newly Organized

NEW YORK (N Y)—News of new glider clubs is given herewith

Employees of the Spartan Aircraft Co have formed Tulsa's (Okla) first gliding club—called the Spartan Glider Club—and plan affiliation with the National Glider Association A group of women known as the Glidettes have been organized by Miss Wanda Cessna, daughter of Clyde V Cessna president of Cessna Aircraft Co Wichita, Kan. They will train on Cessna gliders T C Kitchen has been elected president of the recently organized Tampa (Fla.) Glider Club composed of twenty members, and a glider is to be purchased from the Alexander Aircraft Corp, it is stated

Professor a Director

Six members of the Detroit Aircraft Glider Club, made up of D A C workers have qualified for junior licenses issued by the N G A A Cessna glider is owned by the Atlanta (Ga.) Gliders Club, formed under the direction of Prof T Edward Moodie, Georgia School of Technology A 30-acre tract near Fort McPherson is to become the glider field

The Sunbury (Pa) Glider Club 30 members strong, has recently come into existence and a glider is soon to be bought The group will join the N G A An Eaglerock glider has been purchased by the Omaha (Neb) Glider Club which has elected Don Kelly, secretary, and Donald W Hailey, treasurer Assembly of an Evans Glider Co (Los Angeles) glider, owned by the Marvel Crosson Girls Glider Association, (headquarters in Los Angeles) Squadron One is taking place at the Margaret Perry Airport Culver City, Calif

Rapid Aviation Inc, Omaha Neb is organizing a glider club at Nebraska City, Neb, states LeRoy Drake, in charge of glider sales for the company Gliding devotees of Rockford Ill are planning to form a club very shortly

Club at College

William and Mary College, Williamsburg, Va, have started a glider club and already have their first glider The Oneida (N Y) Flying Club, headed by LaVerne Jones, has voted to expend $400 for the purchase of a glider St Louis high school students recently tested a glider they had built at Parks Airport.

According to C K Wollam, vice president of the Issoudon Sales Corp of Hudson, near Cleveland, Ohio, his firm has found it possible to offer solo time in the Aeronca powered glider machine manufactured by the Aeronautical Corporation of America, Cincinnati, at the rate of $7 50 per hour

Thirty young Stockton (Calif) women have organized under the name of the Stockton Girls Aero Club and plans are being made to purchase a glider which would be flown from the Orange Brothers' Airport in Stockton

Ford and Waco Sued by Curtiss

Litigation Involves Patents Of Latter Alleged Infringed

NEW YORK (N. Y.)—Two suits have been filed—one in the District Court of Delaware against the Ford Motor Co., and one in the District Court of the Southern District of Ohio against the Waco Aircraft Co.—by the Curtiss Assets Corp. for alleged violations of a group of Curtiss patents covering aircraft inventions according to a statement by the Curtiss-Wright Corp., this city.

Though Curtiss-Wright has made no definite statement, it is understood that the case with the Ford concern has to do with the Curtiss marine patents on pontoon construction, tail skid and landing gear design, and multi-engine throttle control. Suit with the Waco firm is along similar paths and includes some patents not pertinent to the Ford case.

Waco Aircraft Co. when approached, stated it had no statement to make concerning the Curtiss litigation, while the Ford firm made similar reply to queries concerning its stand.

The patents under which the cases are brought are among a group licensed for use by other manufacturers under the Amended Cross License Agreement of the Manufacturers' Aircraft Association—a body of 49 firms responsible for 75 per cent of the total U. S. aircraft production last year. Neither Waco nor Ford are members of the M. A. A., therefore this litigation is that of a member against two non-members. The cross license agreement has been in effect for some 12 yr. in one form or another.

Curtiss Firm States Case

The statement of the Curtiss-Wright company follows.

"The bill against Ford cites recognition by the public and the industry of the validity and fundamental character of patents covering inventions of Glenn H. Curtiss, and that the rights of the plaintiff under the patents have been acquiesced in by the War Department of the United States Government, the Navy Department and by many manufacturers and the public in general and that the plaintiff has manufactured aircraft under these patents and granted licenses under the patents to the Army and the Navy and various manufacturers and has received royalties therefrom.

"It further states that the defendant has been notified of the existence of the patents and of the alleged infringement and the defendant still continues and threatens to continue the acts of infringement. It states, also, that the infringement has the effect of encouraging others to infringe the patents to the irreparable damage of the plaintiff and that the plaintiff believes that the defendant has realized large profits and advantages from the alleged infringement the extent and amount of which are unknown.

"It asks for a writ of subpoena to force the defendant to appear in court and make answer to the allegations, a temporary injunction restraining the defendant from making, using or selling, aircraft embodying the inventions covered under the patents, costs of the suit, and an accounting of profits and damages and any further relief as the court may deem advisable or necessary."

Twenty Jump at Once

ROOSEVELT FIELD (L. I., N. Y.)—By employing a Curtiss Condor twenty parachuted men one right after another while flying over this field on May 18 at 2 500 ft a new world's record for mass jumping was established and the possibilities of such a feat in case of danger were demonstrated. The previous mark had been made on Nov 10 1929, when fifteen men and a woman jumped from a Nyrba Sikorsky. The latest record was made during the course of an air meet held under the auspices of Hempstead Lodge Loyal Order of Moose. Three Air Corps privates and seventeen civilians comprised the group.

Canada Lowers Duty for British

OTTAWA (ONT.)—Under the new tariff schedule Canadian aircraft imports duty will be ten per cent in the British preferential class as compared with fifteen per cent previously, but the other classes remain unchanged at 25 per cent and 27½ per cent in the general. Imports of engines for use in aircraft were also reduced five per cent in the British preferential class to ten per cent. Other divisions remain unchanged however at 25 per cent intermediate and 27½ per cent general.

Ford Tour to Start From Detroit Sept. 11

DETROIT (MICH.)—The sixth annual National Air Tour for the Edsel B. Ford reliability trophy will start from Detroit September 11, it has been announced by Capt Ray Collins manager. The tour this year Captain Collins said will consume sixteen days, returning to Detroit on September 27.

As recently announced the new scoring formula devised for the tour planes is as follows:

$$\text{Leg Score} = \left(\frac{\text{Dept of Com Contest Load}}{\text{Dept of Com Horsepower}} + \frac{150}{\text{Stick} + \text{Unstick} + 10} \right) \times \text{Leg Speed}$$

Thus, for example if a plane has a gross weight of 4 600 lb and an empty weight of 2 600 lb according to Department of Commerce figures, it has a Department of Commerce contest load of 2 000 lb.

If this same plane is powered by a 200 hp engine, has a stick of 5 sec, an unstick of 4 sec and averages 130 m.p.h. for a given leg, its score for that particular leg would be 2 000 divided by 200 plus 150 divided by 5 plus 4 plus 10 multiplied by 130, which would give 2 325 70.

Takeoff of the tour on September 11 means a Thursday instead of a Saturday start, which has always been the case heretofore.

Prepare for Elimination Race

HOUSTON (TEX.)—A large oval shaped grandstand enclosing the field which on June 10 will be the scene of the National Elimination Balloon Races, is being rushed to completion here by Houston backers of the event. Offices have been opened in a downtown hotel and ticket sales started under direction of Theodor Alhborn.

"QUOTES"

Bill Stout and Kipling. Throughout the East people are still talking about the hazards of flying and the danger of accidents in the same way that their ancestors talked about railroading. In the West they stopped that several years ago. Flying is just transportation to them now. Some time ago I said in a speech that there were two dangerous parts to an airplane trip—the ride out to the airport and back to town. I hadn't gotten six blocks on my way to the field after saying that when my taxi was knocked over and smashed."—William B. Stout, Stout Air Services.

Once Votes Now Records. "If I may be so bold I suggest that the National Aeronautic Association might well form a women's branch. There are now 265 women pilots in this country—more than that of any two other countries combined. Flying is becoming of increasing importance to women, and I think that an opportunity presents itself to the N A A which has already done such splendid work to assist in fostering it."—Lady Mary Heath.

Aviation and Real Estate. There are thousands of acres of land that may be worthless today even as farm land, but on which aviation is destined to place a respectable value for residential uses. Aviation will increase the size of American cities by multiplying their working population without a housing problem."—Joseph P. Day, realtor.

Exit the Hitches. "United States naval aviation is the best in the world, bar none. In only a few years we have advanced from the point where one in every five landings on an aircraft carrier resulted in a crash to being able to launch 100 fighting planes at ten seconds and have them return to the ship one after another without a hitch"—David S. Ingalls, Assistant Secretary of the Navy for Aeronautics.

Burnelli Gets Patent For All-Wing Design

NEW YORK (N. Y.)—Frederick W Barker, patent attorney and former director of International Airways Corp., announces issuance on May 13 of Patent No 1,758,498 covering the all-wing design of airplanes to Vincent J Burnelli of the Uppercu-Burnelli Aircraft Corp., Keyport, N J. According to Mr Barker, the patent "is basic" and dominates the aviation art with respect to this trend of all-wing design."

Ten years ago Mr Burnelli made his primary application for the all-wing patent, it is stated, and during the time that has elapsed other claims have been developed and added. It was ten years ago that Burnelli built the large biplane with airfoil-shaped fuselage, a forerunner of his latest type twenty-place monoplane exhibited in the New York Legion air show last February.

Seven claims are contained in the patent as follows.

"1 The combination in an airplane of a body portion having aerofoil contour throughout, with its leading edge of full width motors enclosed respectively at opposite sides within said leading edge, and a useful load enclosing compartment located in an intermediate section of the aerofoil disposed in the center of gravity of the airplane.

2 The combination, in an airplane, of a body portion having aerofoil contour throughout, with its leading edge of full width motors enclosed respectively at opposite sides within said leading edge, complementary supporting elements extended from opposite said body portion, and a useful load enclosing compartment located in an intermediate section of the aerofoil disposed in the center of gravity of the airplane.

3 An airplane having an aerofoil element in fuselage form with its leading edge of full width the portion of said aerofoil lying in the center of gravity having passenger accommodation and fuel containing engine propulsive power means housed in said leading edge, pilot and load accommodation, and balance load accommodation at the rear of the passenger accommodation.

4 An airplane having an aerofoil element in fuselage form, with its leading edge of full width the portion of said aerofoil lying in the center of gravity having passenger accommodation and fuel containing means propulsive means housed in said leading edge, pilot and load accommodations between the power means and passenger accommodation, balance load accommodation at the rear of the passenger accommodation, and complementary aerofoils extended at opposite sides from aerofoil-fuselage.

5 An airplane having a central aerodynamically efficient supporting element which constitutes a fuselage of aerofoil contour throughout whose width is considerably greater than its height throughout substantially the whole length thereof and whose upper and lower surfaces are transversely rectilinear the upper surface being generally convex longitudinally and of considerably greater length than its lower surface, said fuselage containing a power plant enclosed in the forward portion thereof propeller shafting projecting through the leading edge of the fuselage and operatively connected to said power plant and propeller means carried by said shafting and disposed in front of the leading edge of the fuselage.

6 An airplane having a fuselage of aerofoil contour whose width is considerably greater than its height throughout the major portion of its length thereby providing an aerodynamically efficient supporting element having a wide nose portion said fuselage carrying a power plant disposed in close proximity to the nose portion a plurality of shafts disposed on opposite sides of the longitudinal axis of the fuselage and in proximity thereto said shafts being operatively connected to said power plant and a propeller carried by the front end of each of said shafts and disposed adjacent the front of said nose portion of the fuselage, thereby serving as tractor propellers

7 An airplane whose body portion enclosingly contains the full power equipment and useful load, said body portion being of greater width than height and the upper surface being generally convex longitudinally and of considerably greater length than its lower surface and having aerofoil contour throughout with its length extended to the empennage for longitudinal stability to thus constitute an aerodynamically efficient supporting element, and complementary supporting elements extended from opposite sides of said central element"

Report Bowlus Production Rate

SAN DIEGO (CALIF.)—Starting immediately, production at the Bowlus Sailplane Co. factory, Lindbergh Field is to be five trainers and five soarers per week, according to Clyde Freeman, general manager of the company. Walter O Locke is now production manager of the Bowlus firm.

New England Tour Entry List Totals 34

SPRINGFIELD (MASS.)—According to present reports, 34 planes will leave Springfield Airport on May 27 for the three-day tour of New England which will embrace six states.

The craft entered include Air Istocrat, United States Aircraft Corp., New Brunswick, N J; Argo, Massachusetts Airways Corp., Springfield, Mass.; Bellanca, "City of Northampton," Northampton, Mass.; Bellanca, Greenfield Tap & Die Works, Greenfield, Mass.; Bird, Brunner-Winkle Aircraft Corp., Brooklyn, N. Y.; Buhl, North Shore Airways Corp., Chelsea, Mass.; Cessna, Cessna Aircraft Co., Wichita, Kan.; Davis D-1, Walter S. Rogers and associates, Boston, Mass.; Fairchild, Fairchild Aviation Corp., Farmingdale, L. I.; Fairchild, Vacuum Oil Co., N. Y.; Fleet, Consolidated Aircraft Corp., Buffalo, N. Y.; Fleet, Harry Herman of Northeastern Aircraft Corp., Longmeadow, Mass.; Fleetster, Consolidated Aircraft Corp.; Ford, Ford Motor Co., Detroit, Mich.; Ford, Pratt & Whitney Aircraft Co., Hartford, Conn.; Keystone Patrician, Wright Aeronautical Corp., Paterson, N. J.; Kingbird, Curtiss-Wright Corp., N. Y. City; Lockheed, Detroit Aircraft Corp., Detroit, Mich.; Moth, Skyways, Inc., Boston, Mass.; Pitcairn, Pitcairn Aircraft, Inc., Willow Grove, Pa.; Ryan, Atlantic Airport, Inc., Westerly, R. I.; Ryan Brougham and Speedster, Detroit Aircraft Corp.; Stearman, Skyways, Inc.; Swallow, Swallow Airplane Manufacturing Company, Wichita, Kan.; Thrush, Curtiss-Wright Corp.; Travel Air, East Coast Airways Corp., Boston, Mass.; Travel Air, Kendall Refining Co., Bradford, Pa.; Verville, Verville Aircraft Co., Detroit, Mich.; Waco, Art Davis, East Lansing, Mich.; Waco, Lieut Robert Fogg, New Hampshire Aviation Corp., Concord, N. H.; Whittelsey Avian, Whittelsey Manufacturing Co., Bridgeport, Conn.

Senate Passes Bratton Bill; Ask Reconsideration

WASHINGTON (D. C.)—Though assailed by the objections of Sen Hiram Bingham, the Senate on May 16, passed the resolution of Senator Bratton calling on the Secretary of Commerce to furnish the Senate with full information respecting each aircraft accident since May 20, 1926. The vote was 42 to 23.

Even so, the resolution did not start its course in the clear, for a motion to reconsider was later offered by Senator David A. Reed, of Pennsylvania, who changed his initial vote against the resolution to the affirmative in order to ask reconsideration.

Senator Bratton reiterated his previously-stated charges that while the Secretary of Commerce "is required to investigate, record, and report to the Senate all information relative to accidents of aircraft" he has only fulfilled the first two of these mandates—those to investigate and record.

Senator Bingham author of a bill authorizing the Secretary of Commerce to subpoena witnesses for the investigation of accidents, again stated that the Air Commerce Act does not give the Secretary power to subpoena witnesses and that all information now in the hands of the Secretary was obtained only through a promise of confidence.

The Senator declared further that the resolution would involve some 3,300 accidents and would require the entire time of one person for at least a year to draft the report. This he said would seriously interfere with the work of the aviation office.

The Bratton resolution follows

Resolved That the Secretary of Commerce be, and he is hereby, requested to furnish the Senate full information respecting each aircraft accident which has occurred since May 20 1926, of which he has a record including therein, among other things, the names of persons involved specifying whether pilots or passengers, the date and place, the make and model of plane, the name, model and number of engine, and the complete findings of the Department as to primary and/or contributing causes of such accident.

Yancey Leaves on S.A. Trip

NEW YORK (N. Y.)—The Pilot, a Wright-powered Stinson Detroiter owned by the Pilot Radio & Tube Corp., Brooklyn, which left here May 14 on a five or six weeks' trip to South America with Rio de Janeiro as its destination, has reached Cuba. Zeh Bouck, radio operator, and Capt Lewis A. Yancey, navigator, both of whom were on the New York-Bermuda flight of the Pilot [AVIATION April 12, p 768], and Emil Burgin, pilot, comprise the crew. One of the purposes of the company's venture is to test a special two-way radio outfit on a long distance flight. A special shielding has been installed on the plane's ignition system to prevent interference with the radio, while to provide extra fuel facilities, a 50-gal auxiliary gasoline tank has been built into the cabin from which the fuel can be pumped into the main tanks.

Third Stinson Branch Established in Chicago

DETROIT (MICH.)—Stinson Aircraft Corp. has announced the establishment of its third factory branch, the Stinson-Illinois Co., which will be located at Chicago. Two other factory branches had previously been formed at Fort Worth, Tex., and Burbank, Calif. Territory assigned to the Stinson-Illinois Co. includes Illinois, Indiana, Ohio, Iowa, Wisconsin, Minnesota and Kentucky. Down town offices have been opened at 105 West Adams St., Chicago, a temporary hangar and service depot established at the Municipal Airport and display quarters are located at 2401 South Michigan Ave. Negotiations are underway by the company to acquire its own hangar and service depot on the airport.

Bob C. Smalley

Bob C. Smalley, war flier and prominent in National Aeronautic Association activities, has been named general manager of the Illinois company. Smalley, a former Chicagoan, recently completed a 13,000 mi. tour of Europe, making a survey of all phases of aviation, including manufacturing and transport lines.

List Facilities to be Afforded

The firm plans to install regular factory equipment for servicing planes and will carry a complete stock of parts and other materials. In addition, factory service men from the Lycoming Manufacturing Co., Williamsport, Pa., will be located at the service station for servicing Lycoming engines which are used in the Stinson Junior and the tri-engined Air Liner Eight. Engine experts to service the other makes of engines which Stinson uses in its planes will also be in the service personnel.

In making the announcement of the formation of the Chicago branch, William A. Mara, vice-president of Stinson, said:

"Establishment by Stinson of factory branches in strategic points of the country will enable owners of Stinson planes to get immediate service under factory supervision. In the three branches established to date at Burbank, Calif., Fort Worth, Texas and Chicago, a full stock of parts and other airplane materials will be carried on hand, and each one of these branches will be in a position to provide factory type service on planes. Factory trained men will make up the personnel.

Four Dealers Named

"The establishment of factory branches will in no way affect our dealers, but will materially assist them in their service to the public. We feel that in the development of aviation in a broad way it is necessary for airplane factories to provide a super service such as few dealers could at this time hope to offer."

Four dealers have already been appointed by the Stinson-Illinois Co. They are: George F. Fisher, Sky Harbor, Ill.; Wilson T. Herren, Barrington, Ill.; A. C. Bender, First National Air Service, Elmhurst, Ill., and the Chicago Aero Sales Corp., located at La Grange, Ill.

It is the company's plan to locate a branch factory in Canada sometime in the near future. Six Canadian orders are now on hand, while the first pontooned Stinson to be delivered in the Dominion this year was a Wright-powered Stinson Detroiter, taken by the Yarrow Aircraft Corporation, Ltd., Vancouver.

March Aero Exports Were Worth $712,779

WASHINGTON (D. C.)—Aircraft exports in March showed a gain of more than $250,000 over February, a study of reports released by the Department of Commerce reveals. During March, 27 planes worth $425,688, nineteen engines valued at $98,958 and parts and accessories (tires excepted) appraised at $188,133 were shipped from this country, making a total of $712,779 in aero exports, compared with $448,978 in February.

As in the preceding month, Canada led in the number of machines received, getting seven valued at $126,501. Other plane shipments were as follows: Argentina five, $72,853; Japan three, $73,275; Java and Madura three, $60,000; Mexico three, $15,995; Chile two, $14,000; Hong Kong two, $21,764; Colombia one, $23,800; Peru one, $17,500.

Parts to Soviet Russia

Six engines representing $29,869, were exported to Panama, while Canada bought four power plants worth $2,380. Engine sales to other countries were: two to Java and Madura, $20,000; one to Germany, $8,500; one to Bolivia, $7,650; one to Trinidad and Tobago, $7,444; one to Brazil, $7,444; one to Union of South Africa, $6,890; one to Argentina, $5,829; one to Japan, priced $2,952.

Soviet Russia in Europe was sold parts and accessories valued at $39,252, and thus led in that division. Similar shipments to other countries were as follows: Belgium, $2,850; France, $1,944; Germany, $5,927; Italy, $17; Netherlands, $1,155; Switzerland, $84; Canada, $34,651; British Honduras, $147; Costa Rica, $707; Panama, $5,088; Mexico, $22,710; Labrador, $24; Trinidad and Tobago, $45; Cuba, $3,070; Dominican Republic, $1,039; Virgin Islands of U. S., $1,064; Argentina, $7,008; Bolivia, $551; Brazil, $22,639; Chile, $1,900; Colombia, $762; Peru, $643; Uruguay, $849; British Malaya, $19; China, $17,160; Java and Madura, $9,871; Japan, $3,446; Philippine Islands, $2,264; Union of South Africa, $36; Hawaii, $1,061; Porto Rico, $150.

Leighton W. Rogers, chief of the aeronautics trade division, Department of Commerce, recently stated that regardless of the fact aviation exports for the first three months in 1930 fell below those in the 1929 corresponding period he believes sales abroad in the first quarter exceeded consumption in the home market.

In discussing exports, Mr. Rogers declared that certain artificial barriers hindering American sales abroad have now been lifted and that additional restrictions are likely to be removed.

"Signatory nations are now allowed to enter into independent agreements with non-signatory countries—of which this country is one—if the non-signatory countries have airworthiness requirements similar to those employed by the convention members. This step was approved at the last meeting of the International Convention of Aeronautical Navigation and should encourage American exporters," said Leighton Rogers.

In making reference to a survey conducted by the aeronautics trade division which showed there were 1,100 planes stored in factories on Jan. 15, Mr. Rogers asserted that machines not marketed profitably in the United States would encounter equal, if not more sales resistance in foreign marts. Plane manufacturers should not depend upon foreign outlets for their profits unless they are provided with adequate facilities for handling an export trade.

Announce Ryan, Curtiss Sales

ST. LOUIS (MO.)—Curtiss Robertson Airplane Manufacturing Co. and Ryan Aircraft Corp. report the recent sale of six and three planes, respectively. Two Moths, a Thrush and three Robins were sold by the former firm, two of the Robins and a Moth going to the Butte (Montana) Aircraft Corp. The Wasp-Ryan and the Lockheed Vegas sold by the Ryan company were purchased by Harry P. Williams, Patterson, La., for use on an airline between New Orleans and Fort Worth, Tex.

Form Universal Supply Division

ST. LOUIS (MO.)—Under the title Universal Supply Division, the supply departments of Universal Aviation Corp. and Southern Air Transport division of American Airways, Inc., have been merged into one. Joseph Steinger, St. Louis, formerly connected with the automotive industry, is to be general manager of the new division, which has headquarters at Lambert-St. Louis.

Trubee Davison Buys Glider Boat

WASHINGTON (D. C.)—F. Trubee Davison, Assistant Secretary of the Army for Aeronautics, has purchased a Peel glider boat.

BRIEFLY

Twenty-seven planes of the U. S. Army Air Corps participated in maneuvers at Havana in connection with the celebration of Cuba's Independence Day, May 20.

An air carnival is to be held at Wright Field, Dayton, Ohio, June 7.

In the recent maneuvers at Baltimore, Md., defending air forces were credited with general success, though the attackers broke through and theoretically bombed a few important points.

William F. Brock and Edward F. Schlee are planning an attempt to break the transcontinental record sometime next month, starting from Jacksonville, Fla. The progress of the flight will be broadcast over a national hookup. They will use a Lockheed Vega.

Fred Melchior has been chosen to pilot the Lockheed Vega plane in which John Henry Mears will attempt to set a new record for circumnavigation of the globe. Mears expects to start about June 1, from Roosevelt Field.

Bellanca Aircraft sales from Jan. 1 to May 10, 1929, were reported as $242,000, as compared with $110,000 in the first five months of 1929.

Marquette League, N. Y., has purchased a Bellanca plane with Packard Diesel engine for communication work between its various Catholic missions in Alaska. It will be flown by Father George J. Feltes, S.J.

Luncheon and tea were served to specially invited guests aboard a tri-engined Ford above Grand Central Air Terminal, New York, recently. The plane's special accommodations were worked out by Ford Motor Co. and W. K. Kellogg Co., Battle Creek, Mich.

Rapid Aviation, Inc., Omaha, Neb., has ordered four Eaglerock gliders for school use.

Stuart Aero Parts Co., Inc., is considering moving from St. Louis to Sparta, Ill., and plans for production of a small plane to sell for less than $1,000 are announced.

United Aircraft Products, Inc., successor to National Aircraft Products Co., Dayton, Ohio, has taken over equipment from the latter company. The president of the new firm is S. J. Sorenson. T. M. Hiester is vice-president, George A. Funkhouser, secretary, and Joseph G. Lehman, treasurer.

National Council of the Boy Scouts of America has approved the formation of an air division.

Gliders owned by seven clubs in or near Akron, Ohio, were exhibited in the auditorium of the M. O'Neil store recently, and it is reported that 10,000 persons attended during the week.

Joint Army-Navy air demonstrations are to be conducted in the vicinity of Groton, Conn., May 24-28. About 35 Army planes will participate.

Capt. Ira Eaker recently piloted a plane carrying Major-General Fechet from Bolling Field to Fort Crook Field, Omaha and return, in one day. The westward trip was made in 8 hr. 20 min., including a stop for fuel at Rantoul, Ill.

There are now 204 licensed women pilots, of whom 22 hold limited commercial licenses, and 21 hold transport licenses.

D. F. Fechtman of Wichita, Kan., is planning a glider flight from near the top of Pike's Peak, in a plane of his own design.

Boeing 80-A tri-engined transports are now offered with special interior arrangements to suit the requirements of individual purchasers.

A total of 1,106 students are now enrolled in Michigan's 38 licensed aviation schools, according to a recent report.

Representatives Named

BARLING—Sprott-Shaw School of Aviation, Vancouver, B. C., for British Columbia.

GREAT LAKES—Edgewater Flying Club, Inc., Chicago, Ill.

FLOYD SMITH SAFETY PARACHUTES—Edgewater Flying Club, Inc., Chicago, Ill.

NEW STANDARD—Carl Dixon, Hartford, Conn., for New England; Clark-Rodgers, Inc., Camden Airport, N. J., for southern New Jersey, and eastern Pennsylvania.

AERONCA—Aviation Sales and Service, Minneapolis, for Minnesota and Wisconsin.

AMERICAN EAGLE—New Orleans Air Transport, Inc., New Orleans.

BOWLUS SAILPLANES AND GLIDERS—Hayes Aviation, Inc., Syracuse, N. Y.; Reuben Fleet, Jr., Buffalo, N. Y.; Castle Flying Service, New York City; C. S. Burke, Detroit; Varney Air Lines, Inc., Oakland, Calif., and Smith and Myres, Los Angeles.

DETROIT AIRCRAFT CORP.—E. H. Parker, Richmond, Va., for the territory between New York and Atlanta.

Require U. S. License For Michigan Aviators

LANSING (MICH.)—Unlicensed pilots can no longer operate aircraft in the state of Michigan, according to a statement released by Capt. Ray Collins, State Director of Aeronautics.

An act passed by the last legislature makes it mandatory to have a federal license to operate any aircraft in the state, and any one violating that law is liable to a $100 fine and 90 days' imprisonment at the discretion of the court.

"Up to the present, we have found only one violator to the state pilot's code, and have turned him over to the proper officials for action," states Ray Collins in his monthly activity report.

The state of Michigan has practically adopted all the federal regulations and now has an inspection force in the field continuously to enforce these rules.

SCHOOLS

NEW ORLEANS AIR TRANSPORT, INC., is conducting both day and night flying courses, with a special class for women. A class for mechanics is being formed, the cost of which may be financed on a weekly payment basis.

RIVERSIDE MILITARY ACADEMY, Gainesville, Ga., will offer as an optional subject a ground school course under the direction of Curtiss-Wright Flying Service.

PALO ALTO SCHOOL OF AVIATION has recently been taken over by the Associated Air Service, Ltd., of San Francisco. The construction of a hangar has been started, and five Fleet planes have been ordered as additional equipment for training purposes. Paul Mantz is director of the school.

CURTISS-WRIGHT FLYING SCHOOL, Boston, Mass., graduated 52 evening students from its ground school recently.

UNIVERSITY OF MINNESOTA, Minneapolis, has nearly completed arrangements with Universal Aviation Schools to have flying instruction given to all the aviation students of the university.

CASSELL FLYING SERVICE, New York City, has opened a primary gliding school at the New York City Airport, Flushing, L. I., and plans shortly to open others in Westchester County and New Jersey. An advanced school is also planned for, to be located at Montauk Point, L. I. Bowlus primary gliders and the Bowlus training system will be used. About 100 students are reported to have enrolled in the school. Students are guaranteed a glider license for $65, regardless of the length of time they require, and payment may be made on a time plan.

CAPE COD GLIDER SCHOOL, South Wellfleet, Mass., reports that applications for training courses have been received from every state in the Union and from Central and South America.

BOEING SCHOOL OF AERONAUTICS, Oakland, Calif., announces that the State Department of Education of California has offered to accept credits earned by students at the school towards the securing of degrees by those studying aeronautics for the purpose of teaching.

New Firms Announced

NORTHERN AIR EXPRESS CO., Merrill, Wis.; C. P. Schmitt, pres.; C. H. Doriot, vice-pres.; E. E. Schmuacher, sec'y.; Jack Munson, treas.; to maintain air transport service and give flying lessons.

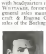
WASHINGTON AIR EXPRESS, Joseph Vance Bldg., Seattle, Wash.; capital $250,000; a holding company for Air Express Agency, Inc., and Air Agency, Inc. August F. Slater, pres.; B. W. Borght, sec'y.

WYOMING AIR SERVICE, INC., Casper, Wyo.; capital stock $50,000; by R. Leferdink, J. Leferdink, A. Leferdink, Allen McLennan and R. H. Nichols.

PERSONNEL

DR. ALBERT F. ZAHM chief of the division of aeronautics in the Library of Congress, has been awarded the medal presented annually by Villanova College for distinguished service in the advancement of science

HAROLD A SPEER, recently sales manager of the manufacturing division of Nicholas-Beazley Airplane Co, has resigned to become distributor for Barling NB-3 monoplanes on the West Coast with headquarters in Los Angeles. JACK WHITAKER, formerly vice-president and general sales manager of Szekely Aircraft & Engine Co takes charge of sales of the Barling NB-3 at the factory


Joseph Steiniger

JOSEPH STEINIGER, recently president of Tuthill-Gardner Motor Corp St Louis Mo. has been appointed general manager of the commercial division and the Universal supply unit of American Airways Inc. The supply unit of S A T has recently been merged with Universal with headquarters at St Louis Municipal Airport

HAROLD A BACKUS, recently assistant to the president of Berliner-Joyce Aircraft Co. is now associated with Metallurgical Laboratories, Inc., Philadelphia, Pa as quality supervisor

J D GOODRICH has been elected president of the Nebraska chapter of N A A. JOHN MCGURK is vice-president C E GODDARD secretary treasurer

DR THEODOR VON KARMAN, former aerodynamics professor at the University of Aachen, Germany, is to direct lighter-than-air research at California Institute of Technology

LIEUT ELLIS M. FAGAN has resigned as chief pilot for Spartan Aircraft Corp to participate in the formation of a new airline to operate from Little Rock Ark

THOMAS A. BATSON has been appointed employment director of Universal Aviation Schools, succeeding GLEN OGLE resigned.

JOHN KENWOOD is now chief instructor of Omaha Airways Inc. J P GOGGINS is sales manager

WALTER J JONES has been made chief instructor of T. C Ryan Flying School San Diego, Calif

GLEN C BURT has been named airport manager of the Twin City Airport Benton Harbor, Mich

W W. WRIGHT has been promoted to the position of airplane sales manager for Curtiss-Wright Flying Service. J G MILLER has been placed in charge of ground and mechanic schools operated by the Los Angeles base. E H RICHARDSON has been appointed traffic manager of the Flying Service. D H ALLEY has been made airport superintendent at Grand Central Air Terminal, Glendale, Calif. and is also purchasing agent for the Flying Service there

WILLIAM KINGSLEY has been made district superintendent of the El Paso-Dallas line of Western Air Express

MALCOLM R WHITE, a director of Colonial Airways System, has been elected president and chairman of the board of American Motorless Aviation Corp, New York, N Y. MAJ. VERGNE CHAPPELLE was elected vice-president and other directors elected are: MAJ.-GEN JOHN F. O'RYAN, R. M. ATWATER, JR, CLARENCE E. DOLL, HOWARD CONKLEY, WILLIAM B MAYO.

M A BAMBACH took charge of the C A T offices in Brownsville, Tex, May 1

HAINER HINSHAW, Washington representative of The Aviation Corp, is now assistant to the president. He will remain at the Washington office

C. T. BLACKBURN has resigned as aviation advisor of the Tampa, Fla, Chamber of Commerce to take another position. In making his resignation, he said that aeronautical affairs in Tampa were at a standstill until the airport situation was cleared up

R B C NOORDUYN and W B HURLBURT have been elected vice-presidents of Bellanca Aircraft Corp. Mr. Hurlburt has been in the automobile business and Mr Noorduyn has been assistant to the president of Bellanca

WALLACE G COURTNEY is now traffic manager of Alaska-Washington-British Columbia Airways, with offices in Victoria, B C

E A DOYLE, consulting engineer for Linde Air Products Co, was elected president of the American Welding Society at the recent annual meeting

CAPT ROY FARLEY has been named general sales manager for Eyerly Aircraft Corp Salem Ore

OSCAR R PARKS has been made field manager of Lambert-St Louis Airport

C L ROLOSON has resigned his position as vice-president and works manager of Keystone Aircraft Corp

HAROLD F KNEEN has been promoted to the position of plant superintendent of Lincoln Electric Co Cleveland, Ohio manufacturers of Linc-Weld motors and Stable-Arc welders

MAJ G. E BROWER succeeds MAJ RALPH ROYCE as flight commander of the First Pursuit Group, Selfridge Field. Major Royce has been assigned to duty in Washington, D C

Plan Gee Bee Canadian Branch

SPRINGFIELD (MASS) — Granville Brothers Aircraft, Inc., of this city manufacturers of the Gee Bee plane are planning to establish a branch factory in Canada, and Zantford D Granville the president, has been making an extensive air tour of Canadian cities with a view to selecting a site for the factory. The Springfield factory is now turning out one plane a week

AERONAUTICAL CALENDAR

May 22-25	All-New England Air Tour starting from Springfield Airport, Springfield Mass.
June 10	National Elimination Balloon Race Houston Tex.
June 28	Annual R A F Display, Hendon Eng.
July 20-Aug 7	International Light Plane Tour, starting from Tempelhof Airport, Berlin Germany
July 21	All-America Flying Derby, starting from Detroit, Mich. Sponsored by American Cirrus Engines, Inc., Marysville Mich.
Aug 9-24	International Gliding Meet, auspices Rhoen Rossiten Gesellschaft, the Wasserkuppe East Prussia, Germany
Aug 23-Sept 1	National Air Races, Chicago, Ill
Sept 1	Gordon Bennett International Balloon Race Cleveland Ohio
	EXPOSITIONS
June 2-7	Northwest Aircraft Exposition, the Coliseum Minneapolis-St Paul Minn. Show Director, Jay Krause, 401 Wesley Temple Bldg., Minneapolis.
June 28-July 6	Pacific Coast Aeronautical Exposition, Oakland, Calif., Municipal Airport
July 6	International Transportation Exposition, Warsaw, Poland.
Sept 6-8	International Aero Exhibition, Stockholm Sweden
	MEETINGS AND CONFERENCES
May 25-29	S A E Twenty-fifth Anniversary Meeting French Lick Ind.
June 9-12	Semi annual meeting A S M E Detroit, Mich
July 3-5	Western States Aeronautical Conference, Medford, Ore.
Aug 26-28	N A E Aeronautic Meeting Chicago Ill
Sept 1-6	Fifth International Air Congress under the auspices of the Royal Aero Club The Hague Holland
	AIRPORT DEDICATIONS
May 24-25	Concordia, Kan.
May 25	West Bend Wis
May 26	Muskogee Okla Municipal Airport
May 27	Turners Falls-Greenfield, Mass
May 30	Delta Colo., Airport
May 30-June 1	Dedication and Air Circus Colusa Calif Municipal Airport
May 30-June 1	Dedication and Air Meet, Bowles Airport Springfield Mass
May 30-June 1	United Airport Burbank, Calif
May 29-31	Abilene Tex. Municipal Airport
June 6	Hutchinson Kan.
June 7-8	Los Angeles Airport Los Angeles Calif
June 10	Elgin, Ill Municipal Airport
June 20-21	Randolph Field San Antonio Tex
June 21-22	Allentown Pa. Airport.
June 28-29	Tyler Tex. Municipal Airport
July 4	Kelso Wash. Airport.
July 4	Curtiss-Wright Airport Milwaukee Wis
July 4-5	Harrisburg Pa
Aug 1-2	McGhee Tyson Airport, Knoxville Tenn
Aug 30-Sept 1	Williamson-Johnson Airport Duluth Minn

AIRPORTS AND AIRLINES

Operators Meeting With Post Office Dept.

WASHINGTON (D C)—Special conferences between representatives of the principal air passenger and mail lines of the country and the Postmaster General were begun here May 19. Attention on the first day centered on the problems relating to the administering of the Watres Bill in so far as it affected transportation of mail by passenger planes

Combining mail and passenger loads is one of the features of the Watres Bill which embodies the following provision "Where the air mail moving between the designated points does not exceed 2,500 cu ft, or 225 lb per trip, the Postmaster General may award to the lowest responsible bidder, who has owned and operated an air transport service on a fixed daily schedule over a distance of not less than 250 mi and for a period of not less than 6 mo prior to the advertisement for bids, a contract at a rate not to exceed $0.40 per mile for a weight space of 25 cu ft or 250 lb"

Although strict secrecy has been demanded by certain of the conferees as to the real events of the conference, it is presumed that the transport officials may have gathered to decide whether to compromise on their demands or fight for contracts on the basis of competitive bidding

The Post Office Department has announced that the operators have agreed to prepare a map of the United States showing in detail a comprehensive plan for an air mail and passenger network. A committee of eleven headed by William P MacCracken Jr. was appointed to work out the system

Canadian Firm Expanding Lines

MONTREAL (QUE.)—A steady expansion of its organization is being carried out by the Aviation Corp. of Canada. In the transport field plans are maturing for a direct service between Ottawa and the city of Quebec, an airline distance of about 225 mi, operated by Transcontinental Airways, a subsidiary. There is a rumor also of a possible affiliation between the parent company and Western Canada Airways, of Winnipeg. Canadian Aerial Surveys has been formed to take over the technical end of Inter-Provincial Airways, another subsidiary

P.A.A. System Has Increases in Traffic

NEW YORK (N Y)—During the first 4 mo of this year Pan American Airways System carried a total of 12,499 persons, it has been announced by J. T Trippe, head of the organization. The figures by months were as follows: January, 2,976, February, 3,476, March 3,237, April, 2,810. The passenger miles flown by months, were as follows: January, 789,426; February 816,601, March 637,007 April, 603,228

The Mexican Division of the system, known as the Mexican Aviation Co, experienced an increase in patronage. There was a total of 891,636 passenger miles flown during the first 4 mo. There is an increase in mail being sent from Latin American points, it was announced and to meet this two Lockheeds have been shipped for operation along the West Coast of South America.

During the whole of 1929, the system carried about 530,000 lb of mail

Abilene (Tex.) Air Terminal From the Air

SHOWING THE layout of the buildings at Abilene's new port. The aprons taxiways and part of runways may be seen. This port was described in the April 5 issue of AVIATION.

Research on Airports To Be Jointly Conducted

WASHINGTON (D C)—The American Engineering Council and the American Road Builders' Association will co-operate with the Aeronautics Branch of the Department of Commerce in a broad research program covering the design, construction and operation of airports. These organizations have had the project under consideration for the past 6 mo and now are ready to proceed to prepare a comprehensive report for future guidance in the development of airports. A joint committee will be created at once and such subcommittees will be organized as may be necessary to carry on the program. A study of the coverage and drainage of airports is a feature that is scheduled for immediate execution.

Dr H E Howe, former chairman of the American Engineering Council's committee on research presented the plan at a session of the Council's administrative board on May 14, together with a report by Council's committee on airports, of which Dr Ralph J. Fogg, head of the department of civil engineering at Lehigh University, is chairman. The co-operation of the Council and of the Road Builders' Association was sought by the Aeronautics Branch because it was felt that the diversity and complexity of the problems involved in airport construction and operation call for participation by competent non-governmental agencies in promoting the establishment of a proper nucleus about which a safe, sound and comprehensive system may be finally established.

Thorough Study Planned

"The policy of 'make haste slowly' will create a greater real acceleration in the advancement of aviation than one of proceeding on hastily conceived and inadequately prepared plans," says the report of Dr. Fogg's committee. "Too much emphasis cannot be placed upon the desirability and necessity for careful scientific planning and execution. With the growing popularity and intensive promotion of aviation airports have sprung up overnight—there being more than 1,500 which have been built in the United States to date—involving the expenditure of vast sums of money and energy. During the past 2 yr alone, the expenditure has exceeded $100,000,000. Besides the airports already built, there are more than 1,000 in various stages of construction or under contemplation, with more to follow

"Some of the ports appear to be well-located, designed constructed and operated, but it is just as apparent that many have been so poorly conceived designed

(Concluded on page 1094)

AIRPORT CONSTRUCTION PROJECTS

East

PREPARATION of plans and specifications for the first unit of the marine airport at Buffalo has been ordered by city officials Actual construction work is expected to begin about Aug 1, and to be completed before the end of the year The plans call for a double hangar 80x220 ft, with a 20 ft lean-to at an estimated cost of $86,000 a 75x140-ft ramp, to cost about $90 000 a 40x60-ft administration building to cost $29,000 and a concrete platform to cost $37,000

A committee has been appointed at Hamburg N Y, headed by Otho Churchill to select a site for an airport and to devise a plan for financing its development The project is expected to involve about $100 000, and includes the construction of hangars, runways and machine shop

The new Harrisburg (Pa) Airport is expected to be ready for use about June 15, when the hard surface runway now under construction will be completed. Before the formal opening scheduled for July 4 and 5, fences will be erected and boundary lights installed

At their airport at Greenhurst, N Y the Newton Aviation Co. of Jamestown, N. Y, has installed two wind direction beacons and plans to erect a three-plane hangar and to install lighting equipment

Contract for a $4,000 steel hangar at the Bristol (Conn) Airport has been awarded by the Reliable Flying Service to Leo F Caprone Co of New Haven

Central

Omaha (Neb) City Council has let a $125 000 contract for improvements on the municipal airport to the National Construction Co of Omaha The $100,000 bonds whose release was voted May 6 by Omaha citizens, with a $25 000 balance in airport improvement funds will pay for the contemplated improvements The project calls for three runways 300 ft wide to be constructed of compressed cinders and asphaltic oil The runways will be 2,100, 2 300 and 3 000 ft long, and will form a triangle Fencing and drainage are also contemplated

It is reported that work is about to begin on the first $75 000-unit of the Wichita Municipal Airport administration building

At Curtiss Steinberg Airport, St Louis all electric wires are being placed underground

South

A 60-acre airport is being established at Borger, Tex The field has been leased for 10 yr the contract for a $3,500 steel hangar has been let, and oil companies have been granted permission to build hangars at the port

A passenger waiting room is being erected at Gilliland Field Quannah Tex and runways in four directions to be 200 ft wide and 2 500 ft long, are being built

The Police Jury of Baton Rouge La, has authorized the Airport Commission to call for bids on an administration building, hangar and field lighting at the airport.

Grading of the McGhee-Tyson Municipal Airport at Knoxville, Tenn, has been completed, and the contract has been let for a 120x100-ft fireproof hanger to cost $20,000

The Standard Oil Co of Louisiana is erecting a 150x100-ft hangar at the Parish Airport, Baton Rouge, La., to cost about $35,000

The city of Charleston W Va., has begun construction work on its airport, which has been leased to the West Virginia Airways, Inc

The Tennessee Aero Corp has leased a farm near Johnson City, Tenn, and will at once begin clearing and grading the site for an airport

West

The Highway Communities Corp, Ltd, which holds a lease on a four-acre tract at the Visalia (Calif.) Airport has announced plans for the erection of a $150,000 hotel on the tract, to be the first of a chain of nine such structures to be located at airports between the Mexican and Canadian borders.

The Portland (Ore) municipal paving plant has completed the laying of 25 000 sq yd of pavement for aprons at the municipal airport at an average cost of $0 56 per yd.

The Klamath Falls (Ore) city council has accepted plans for the two main runways at the municipal port, and will shortly call for bids The runways are to be 2,000 and 1,000 ft long

The Associated Oil Co will begin work soon on the construction of an airport at Clyde, Calif The first runway will be 150 ft x 2,500 ft A flood lighting system will be installed.

The Kiwanis Club of McMinnville Ore, is sponsoring the acquisition of a 200x1,000-ft tract for a municipal airport

Bids have been opened on the conditioning of the 89-acre intermediate landing field near Dillon, Mont.

The Santa Paula (Calif.) Airport Association contemplates erection of a hangar and other buildings

North Central

E W Decker has presented to the city of Austin Minn, the 160-acre Decker homestead for use as an airport on condition that it be called Decker Airport Plans for developing the port are under way

P.A.T. Carries Passengers at Night

PORTLAND (ORE.)—Service for passengers was inaugurated recently by Pacific Air Transport on its night mail run leaving Los Angeles at midnight and reaching Portland at 9 30 a m

Omaha-Des Moines Service Inaugurated

OMAHA (NEB)—A passenger and express service between Omaha and Des Moines has been inaugurated by Pioneer Aircraft of Omaha on a daily (except Sunday) basis A four-place Cessna leaves Omaha each morning at 9 a.m, and starts the return trip from Des Moines at 4 p m The flying time for the trip is 1 hr 20 min F D Bowhan and G E Wilson fly the route

The new service is the fifth passenger carrying line operating out of Omaha, and the third to be started within the past few weeks Rapid Air Transport started a passenger service to Kansas City recently, and Northwest Airways last Thursday began a weekly service between Omaha and the Twin Cities The other two services are the transcontinental Boeing line, and the Brower Air service between Omaha and Wichita

Penna. State Fields Started

HARRISBURG (PA.)—The State of Pennsylvania expects to have its three intermediate landing fields ready for use during the summer On May 27, the Department of Internal Affairs will open bids for grading of the field at Williamsburg, one of the fields on the State air route between Philadelphia and Pittsburgh. The field at Blain Perry County, is being conditioned and shortly grading operations will be started at the Newton Hamilton field The State Aeronautics Commission will probably purchase the field eventually having leased the land with the privilege of purchase The leases have been made under an appropriation of $70 000 from the motor license fund. Lighting equipment will be placed on the State's first three fields as soon as the grading is completed.

Boston Tries Automatic Switch

BOSTON (MASS)—An astronomical clock, governing a master switch that turns on the lights at the Boston Municipal Airport, exactly 15 min after sunset, and automatically turns them off at daybreak, is being tried out at the municipal airport It was made in Switzerland and was bought by the city for $300 Night manager Lieut -Comdr Edwin W Keith, who is responsible for the upkeep of the electric system at the airport installed it

Mamer Line Postponed

MINNEAPOLIS (MINN) — Mamer Air Transport has postponed inauguration of its passenger service between Spokane and the Twin Cities from May 15 to June 1 The company has received delivery of the first of the new Buhl six-place planes which will be used on the eastern section of the line. Mamer flew the plane from Chicago to Spokane in 14 hr

Thompson Line Adds Service for Passengers

DETROIT (MICH)—Through passenger service between twelve Michigan cities and Chicago was inaugurated by Thompson Aeronautical Corp, on May 19 The service, Mr Rheinstrom said, will be daily except Sunday The company's regular mail planes Stinson Detroiters will be employed

The Michigan cities to become way points on the line, it was said, will be those now on C.A.M 27, which is operated by the Thompson company Besides Grand Rapids, Muskegon, Bay City, Saginaw, Flint, Lansing, Pontiac, Ann Arbor, Jackson, Kalamazoo, Battle Creek, and Detroit, the line also will serve Mishawaka and South Bend, Ind The schedule will be the same as that of the mail route, i e, leaving Chicago at 8 a m and flying to Kalamazoo, where planes assigned to the Muskegon the Bay City and the Detroit-Pontiac divisions are connected with

A double section will be flown between Chicago and Kalamazoo on which mail is usually heavy and a Stinson-Detroiter, carrying passengers only, will be used between Kalamazoo and Muskegon, on which division a Pitcairn Mailwing is used to carry the mail A return flight over each of these lines is made during the afternoon converging at Kalamazoo for the flight into Chicago

Fares from Detroit have been announced as follows: Chicago, $18, South Bend $14, Kalamazoo, $10, Battle Creek $8, Jackson $6, Ann Arbor, $4, and Pontiac, $3.

In addition to this mail and passenger service Thompson Aeronautical Corp also operates an amphibion passenger line over Lake Erie between Detroit and Cleveland, using Loening amphibions, and a night air mail line between Cleveland and Bay City, Mich, with stops at Toledo, Detroit Pontiac, Flint and Saginaw E G Thompson is president of the corporation and R C (Tex) Marshall, vice president and general manager

N.A.T. Completes 4 Yr.

CHICAGO (ILL) — National Air Transport on May 12 rounded out 4 yr of operation It started with the opening of the Chicago-Dallas air mail route May 12, 1926, and since then has carried 4,196 920 lb of mail and 176,339 lb of express over that line alone. The company took over the Chicago-New York section of the transcontinental Sept 1, 1927

Davis Florida Line To Be Opened June 15

JACKSONVILLE (FLA)—About June 15 Davis Air Lines will inaugurate passenger service from Jacksonville, Brunswick, Augusta, Savannah and Atlanta The announcement was made by L J Sauerborn, general manager of the company

Planes are to leave Atlanta each day at 9 45 a m standard time The next stop will be at 11 at Augusta, Ga The plane will stop in Savannah at noon in Brunswick at 12 30 p m and arrive at Jacksonville at 2 On the northbound trip, a plane will leave Jacksonville daily at 1 p m., arriving in Atlanta at 4.

Equipment has been arranged for and surveys are being made now, Sauerborn states A new field on the mainland at Brunswick, he says is under construction This will be used for landings instead of the field at St Simons Island several miles out from the city

Report P.A.A., Nyrba to Share Port

MIAMI (FLA)—It was announced recently here that a final agreement has been reached between owners of the land and the executive officers of the Pan American and the Nyrba by which it has been definitely established these companies will occupy the property known as Dinner Key for aviation purposes for a term of years The two companies will maintain headquarters in Miami and will add important improvements to the property

Buildings Being Completed at St. Hubert

ONE OF THE NEW hangars and the administration building which are just about completed at the St Hubert government airport near Montreal This base is equipped with a mooring mast which will be used by the R 100

Bay City to Detroit Passenger Line Opened

DETROIT (MICH)—A twice daily (except Sunday) passenger service between Bay City and Detroit was inaugurated by the Northern Aircraft Corp, of Bay City, on May 15 The company opened the service with a Wasp powered Fairchild cabin monoplane, but will begin using a Stinson Detroiter (Wright 300) within a few days

According to the present schedule planes will depart from Bay City at 9 a m, arriving at Ford Airport at 10 a m and at the Detroit City Airport at 10 15 a m The same plane will leave City Airport at 1 15 p m and from Ford Airport at 1 30 p m, landing in Bay City at 2 30 p.m It will depart again for Detroit at 3 p m, landing at Ford Airport at 4 p m and at Detroit City Airport at 4 15 p m At 5:15 p m the plane will leave City Airport for the final trip of the day, stopping at Ford Airport and taking off from there at 5 35 p m, arriving back in Bay City about 6 30 p m Regular stops will be made at Saginaw, Flint and Pontiac and connections made at Detroit with the Stout and Thompson planes between Detroit and Chicago

Fares have been calculated on a basis of $0 15 per mile for one-way trips and $0 12 per mile for round trips They are as follows

From	To	Miles	One Way	Round Trip
Bay City	Saginaw	12	$1 80	$2 88
Bay City	Flint	42	6 30	10 08
Bay City	Pontiac	72	10 80	17 28
Bay City	Detroit	96	14 40	23 04

Northern Aircraft Corp was organized several months ago by a group of Bay City business men, Clifford W March, former pilot for Thompson Aeronautical Corp, is president George Young, vice president and treasurer and Emil Anneke, secretary Directors include March, Young, Anneke and Franklin B Ward Bousfield Ward is general traffic manager, and Barney Rawson, chief pilot The company maintains offices at 330 Shearer Building, Bay City

Port Columbus Traffic Reported

COLUMBUS (OHIO)—Traffic at Port Columbus for the month of April shows a substantial increase over the previous month, and for the period from Jan 1 to April 30, an increase over any other 4-mo period since the port opened in July, 1929 During April there were 132 transport planes in and out of the field 1 202 regular transport passengers, 34 transient planes and 38 transient passengers For the 4-mo period, including April there were 346 transports in and out of the field 3 003 transport passengers, 212 transient planes and 199 transient passengers During April 462 sightseeing passengers were carried and for the 4-mo period, 731 In April there were 109 student flights

Airway Briefs

Air mail pilots flying between New York and Miami have been requested to report forest fires along the route and fourteen were reported one night recently by Walter J. Shaffer Eastern Air Transport pilot

Tickets for airlines operating from Hamburg, Germany, are now sold regularly on all steamships belonging to the United States Lines

West Coast Air Transport operated 97 9 per cent on schedule from Jan 1 to May 1 During April, 10 1 per cent capacity loads were carried The schedule operated between Portland and Los Angeles in co-operation with W A E has been shortened by one hour All W C A T pilots will hereafter be required to wear uniforms

American Airways planes now leave Dallas daily at 8 15 a m for Cleveland instead of at 7 40, and the flying time has been reduced by 35 min

It is planned to establish two emergency landing fields between San Diego and Los Angeles

Col Roscoe Turner who recently crossed the continent in 15 hr 37 min in a Lockheed plane has announced plans for a transcontinental express service for valuable packages and papers, to cover the distance in three jumps, and in less than 24 hr

Arrangements have been made at Beverly (Mass) Airport to take passengers for moonlight rides along the North Shore during the summer

Colonial Air Transport carried 1,460 paid passengers between New York and Boston during April, averaging 9 7 passengers per trip and exceeding the previous month's total by 242

Passengers on Pacific Greyhound bus lines may be transferred to planes owned by Air Ferries, Ltd , at Vallejo saving in some cases as much as 2 hr on the way into San Francisco Air Ferries, Ltd., is also offering taxi service from Oakland Airports to cities not on regular airways for the benefit of airline passengers

Speedboats are now used to carry airline passengers from Oakland Airport to San Francisco and a saving of about 45 min is effected.

Pilots operating from Boeing Field Seattle, Wash , have protested against the presence of electric wires at the northeast corner

New England & Western Air Transportation operating a Boston New York service through Springfield Mass , carried nearly 250 passengers the first week

On May 12, a Gilbert & Barker oil-burner was taken by plane from Springfield to Worcester, Mass a distance of 50 mi , in 25 min flying time and 1 hr from the factory branch to the purchaser

The Ireland (Tex.) Airport was opened May 17

City and County Board of Commissioners of Florence, Ala., has signed a 5 y[illegible] [illegible] option of purchase [illegible] a tract of land for an airport, to be known as Westmoreland Field

Passengers on Boeing System planes are now charged 1 per cent of the fare for each pound of baggage in excess of 30 lb

The District of Columbia branch of the American Legion has protested against the establishment of a permanent airport in the vicinity of Arlington Cemetery

Western Air Express has reduced the Los Angeles-Salt Lake City fare from $60 to $45

Seymour Field government emergency port at Herkimer N Y, has been opened for use

The New York *Herald Tribune* is now operating a service bureau which supplies free information on all matters pertaining to air passenger transportation

The new Omaha-Kansas City line operated by Rapid Air Transport Inc , carried 106 passengers and 57 lb of express during April, and a net profit was reported

Airway beacons on the routes operated by Boeing System have recently been equipped with automatic lamp changers

Schlee-Brock Corp Detroit, has recently purchased the John R airport in that city for a price reported as $250 000

Interstate Airlines flew three special planes from Nashville Tenn to Louisville Ky for the Kentucky Derby

Station WWAC at Sky Harbor, Murphreesboro Tenn was scheduled to be placed in operation May 21 to broadcast weather reports

A bill proposing a division of aeronautics in the State highway department has been introduced in the Mississippi legislature

Ontario Provincial Air Service has purchased three new Moth planes and two Hamiltons

Tacoma (Wash) Airport was dedicated recently

Air City Airways, Inc , Racine, Wis has changed its name to Racine Airways Inc

The new administration building at Swan Island Airport, Portland Ore was opened May 1

Work is to start immediately on the radio range beacon at Oakland Municipal Airport

Approximately 25,000 persons attended an air circus at Visalia (near Fresno Calif) Municipal Airport May 4

Postmaster General Walter Brown has issued an order for extension of the Los Angeles-Salt Lake air mail route to San Diego, at a date to be announced later

Oakdale (Calif) Airport was dedicated May 10-11.

Commercial Airway Transit Corp has subleased part of the municipal hangar at Port Columbus (Ohio) from Golden Eagle Aircraft Corp and will sell Golden Eagle planes and operate a taxi service

Alaska-Washington Airways has taken delivery of two new Lockheed Vega seaplanes

A bag of mail was blown out of a Pan American Airway mail plane recently by a sudden squall over the Caribbean Sea No other damage was done.

Improvement of facilities costing about $1 000 000 will be recommended in the forthcoming report of the Buffalo Municipal Airport advisory board

City Council of Iowa City Ia has approved a 50-yr lease of the local airport to Boeing Air Transport

B Russell Shaw Co has submitted a report of its findings on the recent tests of five types of lighting equipment at St Louis Municipal Airport to the Airport Commission

The Goodyear blimp "Vigilant" recently made a successful test of the Adams air mail pickup device at Hoover Field

During April, 744 passengers were carried from Montgomery (Ala) Airport, as compared with 423 in March

Research Planned

(*Continued from page 1061*)

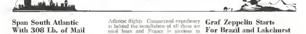
and operated that they represent a large economic waste To prevent further wasteful expenditures and to safeguard life and property there is grave need for the publication by an authoritative agency of reports containing general information for the guidance of public bodies interested in aviation. Notwithstanding the fact that certain fundamental principles are known there is great need for a large program of research, the results of which would enable engineers to develop more efficient and safer airports, and would save the public millions of dollars in the way of unwise expenditures "

Associated with Dr Fogg on the committee which submitted the report are Alexander Klemin, head of the Guggenheim School of Aeronautics Perry A Fellows city engineer of Detroit, Wesley W Horner, chief engineer in charge of sewers and paving of St Louis, Henry G Shirley Commissioner of Highways of Virginia and Dr Howe

Sues For Late Arrival by Plane

ROOSEVELT FIELD (L I)—Alleging that he had hired a plane here on the understanding that he would be landed at Miami by 8 p m Oct 6, 1929, and that he actually arrived the next day too late to attend an important foreclosure sale, Albert J Richey has filed suit against Roosevelt Field, Inc , for $901,334 His is a counter suit lodged when the airport sued him for the $500 fare for the trip and which he refused to pay The case is in Mineola Supreme Court

FOREIGN ACTIVITIES



Span South Atlantic With 308 Lb. of Mail

NATAL (BRAZIL) — Bringing with them 308 lb of mail, Jean Mermoz and his co-pilot and radio operator landed their Latecoere seaplane here May 13, completing a non-stop flight across the South Atlantic from St Louis Senegal The time of the flight was about 20 hr 15 min, and the distance 1 990 mi Adverse weather conditions were encountered during the latter part of the trip The route was patrolled by dispatch boats owned by Compagnie Aeropostale, the firm in whose service the trip was made, but they were not needed. It is believed that the plane, with its 600 hp Hispano-Suiza engine has established a straight-line distance record for seaplanes

The mail carried all the way by Compagnie Aeropostale planes covered the distance from Paris to Rio de Janeiro in about three days, and to Buenos Aires in four Company officials have announced that regular service on this schedule will be inaugurated in the near future Pilot Mermoz was expected to start the return journey, also carrying mail about May 18 or 19 These flights were authorized by the French Government as tests looking toward establishment of regular service, and were sanctioned only after extensive preliminary flights to determine the range of the plane with load, its ability to alight on rough water, etc Radio equipment was carried, and the operator was in constant touch with shore or ship stations

Use Latecoere Seaplane

The machine used was the Latecoere 28 an eight-passenger cabin land plane fitted with pontoons [It was described in the Dec 7 issue of AVIATION] The experiment with this type of machine followed a long period of speculation about the practicability of using flying boats over the route Nothing quite satisfactory along this line has been devised as yet so the seaplane was substituted for the recent test

The flight was noteworthy in a number of respects It represented a big step in the advancement of the company's plans for an all-air service between its European and South American terminals It represents also a counter movement in the field of air mail competition in South America German interests recently inaugurated an air-boat service between the continents over much the same route which has been operated by Aeropostale for about 2 yr

Undoubtedly the operation of fast air mail service between South American and North American points also spurred Aeropostale on with its experiments for the inauguration of scheduled trans-Atlantic flights Commercial expediency is behind the installation of all these air mail lines and France is anxious to derive all the trade benefit it is able from the operation of the air mail line and also preserve the prestige it rightfully secured through pioneering its famous service

France Subsidizes Light Plane Owners

PARIS (FRANCE)—Details of a plan for subsidizing private flying have been announced by the French Air Ministry Initial contribution of about $315 will be made toward the purchase of any type of plane with additional sums of $392 if the plane is two-place and $470 for each of the next two additional places, assuming an endurance of 185 mi for landplanes or 92 mi for seaplanes and amphibions with full load including luggage against a headwind of 31 m p h. Allowances will also be made for engine cost at the rate of $3 92 per hp from 40 to 60, and $6 84 per hp from 60 to 100 Engines under 40 or over 100 hp will not be subsidized

Further payments up to $275 may be made for safety devices or parachutes, and up to $235 for metal construction. Of the total cost of a 100 hp 2-3 passenger light plane with metal structure it is thus possible that more than half may be paid by the Government These subsidies apply naturally only to the purchase of French planes with French engines, and purchasers must guarantee that planes will not be used in any kind of commercial service Allowances for controlled flights will also be made at the rate of $2 55 per hour after 100 hr and $6 27 after 250 hr A sum of $196,000 has been appropriated in the 1930 budget to pay these subsidies

New D.W. 2 Trainer Uses Cirrus III

BROOKLANDS (ENGLAND) — High climbing angle and exceptionally low landing speed are the features of the new D W 2 two place training biplane built by D W Aircraft Co Ltd and now undergoing tests The folding wings are of unequal span, and slightly staggered Wood construction of the simplest and most conventional type is used throughout The engine is a Cirrus III 85 95 hp, giving a normal speed of 70 80 m p h Landing speed is reported as only about 30 m p h The wing loading is 4 4 lb per sq ft , and the power loading 15 8 lb per hp Some changes in aileron and longitudinal control are to be made before the machine is put into regular production

Graf Zeppelin Starts For Brazil and Lakehurst

NEW YORK (N Y)—According to late reports here the Graf Zeppelin arrived at Seville Spain at 11 50 a m (New York daylight saving time) May 19 The trip from Friedrichshafen was thus completed in 23 hr 30 min This was about the length of time allowed in the schedule, though 4 hr were consumed in covering the last 100 mi due to changes of course because of weather conditions The course taken was across Switzerland, over Besancon and Lyons, France, down the Rhone Valley to the Mediterranean and along the coast to Majorca and Gibraltar The dirigible passed over Lyons, France, at 6 15 p m , and over Gibraltar at 7 25 a m On May 20, the ship left Seville for Brazil

FRIEDRICHSHAFEN (GERMANY)—At 12 20 p m , New York daylight saving time, the *Graf Zeppelin* started for Seville on the first leg of its flight to Rio de Janeiro and Lakehurst The ship carried 22 passengers, 42 officers and crew Included among the passengers was Lady Drummond Hay, who has been aboard on most of the Zeppelin's famous flights The current voyage, covering about 18,000 mi , is nearly as long as last year's trip around the world and will bring the airship's total mileage close to 100 000

Carries Fuel for 120 hr

Only 20 min elapsed before the take-off after the ship was removed from its hangar, despite the heavy load which was carried This included six tons of gasoline 4,400 lb of oil, 25,000 cu m of Blau gas fuel, nearly two tons of water ballast and oil This supply was considered sufficient for 120 hr of flying Due to the heaviness of the ship, 500 lb of oil and 500 lb of water ballast were removed just before starting The *Graf Zeppelin* is insured for $768 000 and $360,000 life insurance is carried for the crew

The useful load, in addition to passengers, included 1,200 lb of mail, 2 000 lb of provisions and 1,500 lb of ice Among the provisions were 120 bottles of wine, 6,000 eggs, and 200 lb of special bread The chef is Otto Manz, and his menus include such items as fish pigs' ribs and sauerbraten In order to lift the unusually heavy load, the dirigible's gas bags are filled with 75,000 cu m of hydrogen

Among the other important passengers are Capt Harry E Shoemaker U S N Dr Martin Wronsky director of Luft Hansa Capt Joachim Bretthaupt of the German Navy Karl von Wiegand American newspaper correspondent and other newspaper writers

Milan International Fair Features Aviation Exhibit

MILAN (ITALY)—An extensive aeronautical exposition was held here recently in connection with the International Fair, and received very considerable public attention. Nearly all of the exhibits were of Italian manufacture, the only exceptions being Renault, Lorraine and Farman engines. But and Isotta Fraschini also showed a considerable number of engines, while Alfa Romeo exhibited Jupiter and Lynx engines manufactured under license as well as a new 220 hp. model which is the first Italian radial in that power class.

Caproni contributed the largest exhibit to the show. New models shown were the 101 twelve-passenger monoplane which is fitted with three Lorraine engines, and the light 100 T using an 80 hp Isotta Fraschini Asso 80 R1. The company also showed models of the giant C.6000 and other Caproni planes, together with the Spiga wheels and Pirelli tires used on the large plane. An improved model of the Breda 15 was shown, fitted with oleo split-type landing gear, and ailerons arranged to be used as a brake in landing. Fiat besides engines, exhibited the CR 20 fighter, powered with Fiat A 20 430 hp engine. The other large exhibit was by S.I.A.I. and S.A.M. in collaboration with Isotta Fraschini. An S 55 twin-hulled flying boat used on S.A.M. lines attracted as much attention as anything else in the show, while the technically minded were especially interested in the new Asso 1000 engine, fitted with reduction gear, and said to develop 1 200 hp.

Aircraft Exhibits at Milan International Fair

British Build 40-Place Planes

LONDON (ENGLAND)—In order to accommodate increased London-Cairo traffic expected when the Cairo-Cape Town line is opened, Imperial Airways has ordered eleven new 40-passenger planes. Eight of these are Handley Page land machines which are being constructed with two 20-passenger cabins having buffet and lavatory between. The other three are flying boats ordered from Short Bros., to be used in crossing the Mediterranean. Both types will be powered by four aircooled engines. They will supplement the present Imperial Airways fleet which consists of 30 multi-engined planes or flying boats. The new machines are scheduled to be put in service late this summer.

Miss Johnson Misses Record

SINGAPORE (INDIA)—Leaving here the morning of May 19 for Sourabaya, Java, Dutch East Indies, Miss Amy Johnson had given up hope of breaking the record of fifteen days for a London-Australia flight held by Bert Hinkler. She left England May 5 in her Moth plane and was beating Hinkler's time when she was delayed by a minor accident near Rangoon, Burma.

U.S.S.R. Expands Aviation Activities

MOSCOW (RUSSIA)—Two new airlines have recently been opened by the Soviet Government, according to a United Press report. They are Archangel-Siktivkar, 575 mi., and Kharbarovsk-Nikolaevsk, 680 mi. In addition, a line between Moscow and Tashkent, which will be 1,850 mi., is now being surveyed and is expected to begin operation in July. Later this line is to be extended into Afghanistan. It is also planned to inaugurate passenger service on the Moscow-Irkutsk mail route sometime in August. This line is later expected to form a link in the proposed Berlin-Tokyo service planned by Luft Hansa. Service for this season on the Moscow-Berlin route was begun May 1, via Smolensk, Kovno, Koenigsberg, Danzig, which is 87 mi. shorter than the route by way of Riga which was used last year. Service will continue till Oct. 15.

Growth of aviation in U.S.S.R. is indicated by the fact that on the basis of present estimates, 2,800,000 mi. will be flown this year by Soviet passenger planes operated by the Dobrolet trust, as compared with 1,550,000 mi. last year. It is also anticipated that 22,000,000 acres of land will be photographed from the air this year, as compared with 10,000,000 acres in 1929. Airports are being constructed and meteorological stations established as rapidly as possible.

Report Mail Service in S. Africa

JOHANNESBURG (SOUTH AFRICA)—During the first six months of operation of air mail service in the Union of South Africa (Aug. 26, 1929–Feb. 26, 1930) 6,161 lb. of mail were carried. The total distance flown was 130,000 mi., including 32,000 mi. of private passenger trips, in 245 flights. There have been no accidents. In this period Gipsy Moth planes were used, but in March a six-passenger Fokker was placed in service.

Form International Glider Body

DARMSTADT (GERMANY)—As a result of the first international congress of glider pilots held here May 12-13 a permanent international research committee on soaring flight is to be formed. Delegates from Belgium, France, Great Britain, Holland, Hungary, Italy, Germany and the United States signed the protocol calling for establishment of the new body. Dr. Wolf Hirth, veteran German glider pilot, is expected to have a prominent place on the committee.

Vickers Offers New Transport

LONDON (ENGLAND)—Vickers Vastra is the name of a new 12-passenger high wing cabin monoplane produced by Vickers Aviation, Ltd. It is of all-metal construction and designed to use several different types of power plant ranging from a single Bristol Jupiter to two Armstrong Siddeley Jaguar or three Mongoose engines. Pay loads of from 1,160 lb. as a single-engined seaplane to 2,460 lb. as a multi-engined landplane may be carried. Top speed is from 131 to 167 m.p.h.; with cruising speeds about 20 m.p.h. less. The fuselage is metal-covered.

Lower Calif. to Have New Line

MEXICO CITY (MEXICO)—Interests represented by J. M. Grajales Gonzalez of the Ministry of Communications and Public Works have received a concession for operation of passenger, mail and express service between Zaragoza, on the U. S. border and San Jose del Cabo, in the southern district of Lower California. Intermediate stops will be made at Agnas Calientes, Ensenada, Rosario, Santa Rosalia, Mulege, La Paz, Todos Santos and Cabo de San Lucas. The service may later be extended to Puerto de Altata and Mazatlan, Sinaloa, from La Paz. The main line must be in operation by Aug. 1, and it is reported that twelve American planes will be purchased.

Foreign Briefs

Sir Henry Segrave is at work on the design of a four-passenger monoplane, intended for high-speed long distance use, which is said to embody several very unorthodox features.

A six-place Hawk Moth has been fitted with Whirlwind 300 hp. engine and special cowling designed by the DeHavilland company. The plane ordinarily carries a 240 hp. Lynx engine.

Two small semi-rigid airships are to be built this year as part of the aviation program of U.S.S.R.

There are 667 non-military airplanes in Italy, of which 29 are the property of private owners.

Several important fare reductions have recently been made by Italian air lines. New lines are to be opened soon between Milan-Venice, Pavia-Genoa, and Trieste-Fiume-Venice.

Breda is testing a new bombing plane with three Asso 500 hp. engines, and Caproni has another with three Asso 1,000 hp. engines. S.I.A.I. is also testing two new types of planes.

Fiat A.22 engines are to be used on the Dornier Do X which is being built for Italy.

The Second International Exhibition of Touring Planes will be held at Rome May 23-June 8.

K.N.I.L.M. has announced plans for a Sourabaya-Darwin-Brisbane-Sydney line to be started next October when service on the route between Europe and the Dutch East Indies is resumed. Two new Fokker tri-engined planes will be used, carrying twelve passengers and 2,000 lb. of mail or freight.

The Junkers G-38 made a 10½ hr. flight May 14, carrying twenty passengers. This constitutes its first extensive test, and results were pronounced entirely satisfactory.

As a result of recent casualties, it is expected that aerial trapeze exhibitions and similar stunts will be forbidden in Germany, though acrobatic flying will be permitted as before.

The U.S.S.R. plans to construct an air base at Wrangel Island, in the northeast part of Siberia, to serve as a terminal on a Yakutsk-Irkutsk line.

At a recent dinner given in his honor by the Royal Aeronautical Society, Dr. Hugo Eckener said that use of helium was necessary for safe general operation of an international Zeppelin line.

Non-commissioned officers and privates in the Mexican Army will be admitted as students in the School of Applied Aeronautics hereafter under certain conditions, according to a new ruling.

A number of Bristol Bulldog single-seater fighters have recently been delivered to the Royal Australian Air Force.

Plans for a new British dirigible, R 102, to be larger and faster than R 100 or R 101, are now in the hands of designers. Following recent tests equipment for receiving pictures or maps by radio has been installed in both British airships.

Yugoslav Aviation Co. will open a line between Bratislava, Czechoslovakia, and Zagreb, Yugoslavia.

A total of 47,383 lb. of mail and 469,040 lb. of freight was carried over the four lines operated by Junkers Flying Service in Persia in 1929.

An additional plant near Rostock, Germany, has been acquired by Ernst Heinkel Flugzeugwerke.

Aero Industri Stratus, Kungsor, Sweden, is manufacturing a 40 hp. 4-cyl. in-line engine, weighing 113 lb., to sell for about $1,000.

With the opening of Hull Municipal Airport at Hedon, England, the country has five municipal fields, and Sir Sefton Brancker reports that plans for 21 more are under consideration.

The first congress of the Federation Nationale Aeronautique de France et des Colonies, held recently at Oran, Algeria, was opened by M. Laurent Eynac, Air Minister, and presided over by M. Soreau, chairman of the Federation.

C.A.M.S. company is building a 2,400 hp. metal flying boat weighing 35,000 lb. and a new amphibion.

Capt. Dieudonne Costes has installed a 650 hp. Hispano Suiza engine in his Breguet monoplane in place of the 600 hp. engine used on the flight to China, and is testing it in preparation for a trans-Atlantic flight. Maurice Bellonte will accompany him.

Vickers twin-engined planes, said to have a cruising speed of 140 m.p.h. with a payload of 3,000 lb. have been ordered for the Adelaide-Sydney service.

The Peruvian Air Force is planning to send seven planes on a goodwill tour of Chile next September.

Boys of sixteen are to be trained by the Japanese Government as a preliminary to entering the Air Service. They will receive 3½ yr. of instruction consisting of naval duties, seamanship and preliminary aviation instruction. Ninety students are to start the first class.

Luft Hansa Increases Operations

BERLIN (GERMANY)—Reduction of from 7 to 5½ hr. in the Berlin-Paris time is the most important change in the new schedules recently put into effect by Luft Hansa. This was accomplished by omitting the stops previously made at Hanover and Brussels. On April 1, the company opened a Geneva-Vienna line, with stops at Zurich and Munich. The Berlin-Kiel, Berlin-Bremen, Berlin-Flensburg, and Berlin-Breslau Gleiwitz lines operated last year are all to be re-opened this season. An air-rail line to Barcelona is also being inaugurated, reducing the time between the two points from about 40 hr. to less than 20 hr. The total mileage of routes covered by Luft Hansa planes on the spring schedule is 7,231, as compared with 4,470 during the winter months. By July and August, it is expected that this mileage will be increased to 18,750, and company planes are expected to fly over 6,250,000 mi. during the year.

Guinea Airways, Ltd., Reports Traffic Growth

GRANVILLE (NEW GUINEA)—During December, 1929, and January, 1930, Guinea Airways planes carried 519,446 lb. of freight, as compared withh 529,057 lb. for the combined air services of Australia from the time of inauguration to Nov. 30, 1929. In two years and two months operation of Guinea Airways, from the time of opening service to Jan. 31, 1930, 1,769 pay flights were made, 2,792 passengers were carried, and 1,488 tons of cargo were transported. Despite the fact that the route flown passes over a mountain range at a height of 9,500 ft., there was not a single accident.

The company, which is not subsidized, provides the only effective means of transportation from the coast to the gold fields inland from Salamaua. Four tri-engined Junkers planes are used, and two special freight-carrying machines are under construction which will be used in 1931 to transport about 2,500 tons of hydro-electric power plant and dredging machinery for Bulolo Gold Dredging, Ltd. Included in the contract is the transport of a single casting weighing 6,000 lb. Freight rates have been reduced several times since operations were begun, and are now only about half of those charged at the start.

British Floodlight

MOBILE FLOODLIGHTS of the type illustrated are being supplied to the British Government by Chance Brothers & Co., Ltd., Birmingham, for use at various airports on the Indian air mail route. The lamps used are of 10 kw. capacity, power being supplied from a generator driven by the engine of the truck. Mounting is such that, on occasion, the light may be tilted and revolved for use as a beacon.

WHAT OUR *Readers Say*

Aviation Insurance

In the March 15 issue of AVIATION we published a letter from Francis C Harwood vice-president of Chesapeake Flying Club, Inc., Baltimore Md in which he asked assistance and information with regard to insurance for his organization Some time later, we received a letter from Miss Helen Lee, reproduced below in which she recommended a plan of self insurance for flying clubs, and commented somewhat adversely on aviation insurance as available at present Feeling that the subject is of sufficient interest in our readers to warrant more extensive treatment we sent copies of Miss Lee's letter to several leaders in the field of aviation insurance with a request for such comments or replies as they might wish to make Three such replies are reprinted herewith below Miss Lee's letter—Ed

To the Editor

The letter of Mr Francis C Harwood in your March 15 number is very interesting, for there is no doubt that, from the airplane operator's standpoint, it is pure folly to carry any kind of insurance with the exception of fire on the ground and the liability lines That the insurance company has problems of its own in this respect is, no doubt, true, but certainly from what I have observed and experienced with aviation insurance other than the lines above mentioned, the operator simply adds to his cost of doing business and gains no protection whatever

Having been brought up in businesses where insurance was a matter of course, and where rates were reasonable and one had a reasonable opportunity of collecting in the event of loss, when I became connected with the aviation business some five or six years ago, I was rather terror-stricken at the thought of conducting a business with no insurance protection If any company was writing aviation insurance five years ago, I do not know of it, although I brought the subject up with every insurance man I saw I kept a very accurate record of major and minor losses in relation to the number of hours and distance flown and appointed myself a committee of one to bring aviation to the consciousness of every insurance representative that I came across

About a year and a half ago some of the companies began very timidly to accept risks Rates were terrific When one read most of the policies about all he could make out of it was that the insurance company said "Heads I win, tails you lose" Even today, the aviation insurance policies are so highly technical that it is practically impossible to operate an insured airplane without unconsciously violating some warranty and rendering the policy void

Recently, I was asked to review the operations of a large transport line for the past five years, to figure out what losses of every kind—major and minor—totalled, and what insurance premiums would have totalled during the same period (using rates in effect now, which are somewhat lower than they were a couple of years ago), and what recoveries under policies would have been, taking into consideration all factors surrounding the case, as for instance the fact that while planes were insured for ordinary flying if they were used for student instruction the policy was inoperative during such flights and no recovery was possible in the case of damage in the hands of the student We found out that during that period we paid out approximately $60 000 more than all of our losses of every kind, for our insurance premiums In other words, we increased our cost of doing business by $60 000 during that period and had very, very little protection In most cases where we have had loss or damage claims they have been disallowed on highly technical grounds although they would have been allowed readily enough in corresponding cases in any other business

After the survey was made we decided that in our case there was but one thing to do, and that was cancel all of our insurance with the exception of fire on the ground and the liabilities Then, for minor losses, we are setting aside a definite sum each month which we place in a special fund to be used only to take care of the loss and damage not insured, but insurable under an aviation insurance policy

In Mr Harwood's case such a plan would work out something like this About 35 cents an hour would be paid into the fund until such time as it reached the value of one of the airplanes The fund would be kept in an interest bearing account with the bank and the interest earned added to the fund The club would agree on a deductible [illegible] $250 for the planes it is flying [illegible] any damage or breakage below this amount would be paid out of current expenses the same as if an insurance policy was in force Any losses over this amount would be paid out of the fund As further flying equipment was added, the fund would be increased as to principal, but [illegible] exceed 25% of the investment in flying equipment As withdrawals were made from the fund, the fund would be reimbursed at the 35 cents an hour rate until it was again at a level of 25% of the investment in flying equipment At the beginning, with only two planes, they should have the price of at least one of them in the fund

The advantages of such a plan are that the money is instantly available when needed, the cost is really less than the insurance premium, if care is used by the members it is possible to operate a plane for several hundred hours without loss in excess of the deductible item, and there is no haggling when a major loss occurs and the money is needed for replacement of equipment or major repairs Once the fund is built up to its predetermined minimum, there is no more cost to the members and since the insurance premiums themselves must be paid out of club funds and thus are assessed to the members themselves, there is no greater burden on the members in building up a fund that is theirs without question than in paying an insurance premium on a policy that may or may not insure

After some years of experience in the operation of aircraft, I am convinced that it is less costly and more satisfactory for the operator to carry his own insurance, and I feel sure that if Mr Harwood's club carries out such a plan, he will find that it will cost the club less to build up and maintain the fund and carry its own losses below the predetermined deductible than to pay insurance premiums, carry losses below the deductible set in the policy, and the losses that are sure to be disallowed on purely technical grounds

Helen Lee

Torreón, Coahuila Mexico

To the Editor

Thank you for sending me copy of the letter sent by Miss Helen Lee re aviation and insurance in Mexico

It is impossible to put in a few words the sensible answer to this letter It refers to aviation insurance over a five-year period and it must be remembered that five years ago conditions were considerably different from the way they are now, both insuranceewise and from the standpoint of operation

Some of the biggest and best operators in the country carry full insurance coverage and it is my belief they are way ahead of the game as the result of having done so Western Air Express carried its own crash insurance until this year and even with Western Air's operating record officials were of the belief that it would be cheaper to insure against crashes than to cover themselves

We, the underwriters on this risk, now rather wish they had continued to carry it themselves, as we had two total losses and three partial losses, amounting to somewhere in the neighborhood of $50,000, in the first 60 days of the policy.

While it is true that two or three years ago insurance policies did contain a great many technicalities (in fact this was the major reason for my becoming interested in aviation insurance), technicalities at the present time do not enter into it We of course have a fire escape open in case the loss is one that would be unfair to pay and pass along to the rest of the industry

In two years of operation, we have denied liability on one loss This was the case of an old Curtiss Sea Gull, left moored on Biscayne Bay during the recent hurricane No attempt was made to move it even though storm warnings had been issued for three days One of the officers of the company rather proudly made the statement to one of our friends that "it was insured and was a little old anyway" We denied liability on the ground that reasonable precautions had not been observed, and we are willing to fight this thing through all of the courts in the country if it should become necessary

I do think that for certain air lines, which have a large number of aircraft of more or less uniform value, to carry full crash cover is rather expensive I believe, however that an excess of loss policy is certainly good business from their standpoint

At the present time every air line has what we call an "expected trade loss" resulting from crash It is certainly nonsensical for them to pay us a premium on this expected trade loss in order that we may pay them back when it happens

Let us assume that an air line over a three or four year period has averaged about ten per cent loss to equipment per annum as the result of crash They should face this fact and give it effect in increased ratas and set up an operating reserve to take care of it In my opinion they would certainly be smart to insure the loss in excess of this expected loss

As I said at the beginning of my letter it would require a book to express my views on the letter in question There are certainly some very sensible statements contained therein but there are other paragraphs that seem to me far from true

Reed M Chambers

United States Aviation Underwriters, Inc New York N Y.

To the Editor

I have for acknowledgment your letter of the 3rd inst with which you enclosed copy of a letter dated the 19th ult and signed "Helen Lee" I shall endeavor to take Miss Lee's points in the order she makes them.

"The operator simply adds to his cost of doing business and gains no protection whatever"—I am completely at a loss to understand this statement. Certainly, as far as my experience goes, if an aircraft operator pays a premium to one of the insurance companies I am connected with, he receives excellent value in the form of a policy of insurance which *protects him in accordance with his desires as made known to the insurance company*

"If any company were writing aviation insurance five years ago, I do not know of it"—Comprehensive aviation insurance has been procurable in New York and through any reputable insurance broker, or through the agents of the companies issuing aviation insurance policies, for a good deal more than five or six years

"Rates were terrific"—The companies I have represented have been doing business over a very long period of years, during which period they have written a sufficient volume of business to secure a true average The underwriting results over that period indicate very clearly that rates of premium far from being terrific, were only just enough to make both ends meet up to about two years ago and that during the past two years rates of premium have not been sufficient to avoid the insurance companies taking a substantial loss over their entire volume of aviation business

"Aviation insurance policies are so highly technical that it is practically impossible to operate an insured airplane without unconsciously violating some warranty and rendering the policy void"—Aviation is perhaps more analogous to marine enterprise than anything else, and you have only to compare the aviation policies of the companies we represent with a marine policy to come to the conclusion immediately that the aviation policy is far less technical than a marine policy Moreover, the aviation policy is written very closely along the lines of automobile policies which are well understood by millions of people Aviation policies are just as little technical as it is possible for the insurance companies to make them, for the companies realize very keenly that the simpler they can make the coverage the more marketable it will be

In the fifth paragraph of Miss Lee's letter she seems to complain that aviation insurance is done by the insurance companies in an unfair way because it appears from a survey she has made of one air transport company that it paid out more in premiums than it received back in losses paid to it The answer is of course, that the premium paid is for protection and that in the case of any individual policyholder whose premiums exceed losses paid then such excess is used to pay the claims of other policyholders In short insurance is a matter of average, and it cannot be said that rates of premium are unfair unless the insurance companies make an excessive profit. It is quite impossible for insurance companies to make continued excessive profits First of all, their published returns must show such profit, and if it is excessive, it will at once result in competition which will bring rates down Again, the Insurance Departments of the various states will not permit excessive profits to be made, and if the underwriting profits are shown by the annual state return to be excessive, then the Insurance Department will at once call upon the insurance company to put its house in order

"In mose cases where we have had loss or damage claims, they have been disallowed on highly technical grounds although they would have been allowed readily enough in corresponding cases in any other business"—It is very difficult to reply specifically to such a general statement I would point out, however, that any insurance company which makes a practice of acting unfairly in disallowing claims on highly technical grounds or any other grounds will very soon be out of business I have no hesitation in declaring from my experience that unless an insurance company or underwriting agent acts fairly in the matter of claim settlements and afford their agents throughout the country a good and satisfactory claims service, it will very soon be out of business

In the rest of Miss Lee's letter she descants upon the subject of self-insurance In the event of an enterprise embracing a sufficient spread of risks to make it possible, then a limited amount of self insurance can be carried, but I can assure you that very little can be done in that way and that a self-insurance fund cannot be administered soundly unless it is fortified by laying off a large part of the risks in the form of what are known as surplus lines and excess lines In the case of any one of the largest airway companies in this country, it is quite certain that if it were to self-insure 100 per cent it would need to average its risks over a period of anything from twenty to fifty years and to maintain an enormous emergency fund, otherwise a good sized catastrophe would completely wipe out the self-insurance fund and put the company in a hole for very many years I repeat that a certain amount of self-insurance may be done in the cases of certain really large enterprises, but even then it cannot be done soundly except to a limited degree and unless it is fortified by laying off surplus and excess lines with outside insurers Again, it would be necessary for the self-insurer to maintain a complete and costly legal-technical organization for dealing with liability claims

H. Barber,

President,

Barber & Baldwin, Inc

New York N Y

To THE EDITOR

I have read with the greatest of interest Mr Harwood's letter in your issue of March 15th The insurance problem that he cites is admittedly a very difficult one on account of the vicious circle that exists. The members of the Flying Club are faced with the payment of, as he expresses it, "a huge premium" or going without adequate cover He admits that he has exhausted every effort to procure the insurance for the Flying Club through his own channels and that the N A A has presented the only workable plan which he has seen so far Unfortunately there has been but one club formed under this plan, so that I feel there has not been enough experience to prove whether there are other weaknesses in it than those of insurance

We now come back to the vicious circle that I spoke of On an admittedly preferred risk, insurance will be accepted by underwriters on the basis of selection but on a risk of questionable nature their rates go up until they get a spread which is merely getting their eggs distributed The N A A plan has two factors in it which make for the high premium, neither of which I feel can be eliminated The first is the fact that the initial premium paid by the member is the only premium that he pays, no matter how many times the plane is cracked up The second feature is that any member of the club can operate the plane and that the insurance extends to cover individual liability, as well as the liability of the club as a whole

With reference to the $300 deductible to which Mr Harwood objects on account of its being so high if he will refer to other aviation insurance I think he will find this is an extraordinarily low deductible. As was stated in the comment on his letter the deductible feature parallels the deductible used in automobile insurance for by using such deductible the underwriters are relieved of the payment of a multitude of small losses, the expense of which to the underwriters would increase the premium to a far greater sum than the deductible.

If it were possible to secure the spread I think there is no question that it would be possible to reduce the rates unless of course the experience should prove so very disastrous to the insurance company that it was losing money Insurance companies are trying to supply to the aviation industry protection which it must have and great strides have been made towards getting the best possible conditions and the best possible rates

This brings me to Miss Lee's letter, as she too is commenting on Mr Harwood's letter First let me say that I feel her letter shows an excellent knowledge of insurance but possibly not as close a contact with aviation insurance as she might have had She states first that she knew of no company writing aviation insurance five years ago Let me assure her that they not only were writing such insurance as early as 1919 for I placed many individual risks and in 1923 placed the insurance of the Aeromarine Airways under which this company collected losses, principally crash, approximately equal to the premiums

She states further that she feels it is pure folly to carry any kind of insurance with the exception of fire on the ground and liability lines We have recently paid through this office on single property damage losses amounts in excess of $10,000 During the last week we have paid $42-000 in crash losses and during one week in December we paid more than $150,000 in crash losses to various assureds In every case these losses have greatly exceeded the premiums and it is only by the spread of risks that the underwriters are able to continue

As far as the wording of the policies is concerned, I entirely agree with her that in the past they have been very difficult indeed, but her broker should have been able to take out most of the objectionable features with little or no additional charge if he had had the experience in handling aviation insurance to show him which of these conditions could be eliminated This is no criticism, however, of the individual for the average broker today is at sea with an aviation risk, and will continue to be until the aviation industry is very much more standardized than any of us have a right to hope for for some years to come

Her plan for Mr Harwood's club is interesting, but would fail if it were applied to any particular club having one plane which was involved in two or three substantial losses in a year It would be merely the old problem of having to tax each member again and yet again for each of these accidents, and it is perfectly conceivable that some members might drop out and the whole club fail The purpose of having the very extraordinary condition in the N A A. policy which calls for no reinstatement premium was to cover exactly this situation

She speaks of haggling over losses There is no excuse for any properly run operation, and this includes the financial side having an unpaid claim on any of the normal or even unusual phases of its business Disallowed claims which seem to be on technical grounds result either from carelessness in the office or from wilful disregard of operation rules outside

This is necessarily a general discussion No specific lines were mentioned by name, yet it is safe to say that aviation insurance can and does protect the operator and demands only what every business demands attention to its detail

J BROOKS B PARKER
Parker & Co,
Philadelphia Pa

Abstracts AND *Reviews*

California's Airports

CALIFORNIA AIRPORTS AND INTERMEDIATE LANDING FIELDS, *Booklet Compiled and Published by the Airways Service Division, Department of Aviation, Richfield Oil Company of California*

AN INTERESTING and useful booklet describing California's airports and intermediate flying fields, has been compiled and published by the Airways Service Division, the Department of Aviation of the Richfield Oil Company of California. In addition to individual descriptions of each airport throughout the state, similar to the Airway Bulletins of the Department of Commerce, there are a number of sections devoted to information of value to anyone flying through the State

The description of each airport differs from the Federal bulletins chiefly in that the airport illustration is a photograph which has been lettered to describe essential details instead of a drawing such as the Federal publication uses. The map showing the relative location of the airport to other airports and cities nearby is much larger than in the Federal bulletin. It occupies the entire back of the sheet and includes a much larger area with ground details carried out to a greater extent.

Each of the regional maps appearing on the back of the sheet carries a rather complete series of symbols which distinguish between various airport installations as follows: military or naval field, with a beacon, military or naval field, without a beacon Commercial and municipal airports with a beacon, commercial and municipal airports without a beacon Mark auxiliary or emergency field, unmarked emergency field, flashing beacon or blinker, anchorage etc. Most of these pencils are in red to make them easily readable.

The other items include such things as the following Sample service record, lubrication charts for aircraft engines, on the basis of Richfield Oil, a magnetic declination map for the State of California period of sunshine tables for every day of the year in the State the location and telephone number of all the United States private Weather Bureau locations in the state, a directory of the Aeronautics Branch representatives in the State a copy of the Federal Air Traffic Rules a copy of the State of California Air Traffic Regulations, and a pilot's daily flight report form

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British Engine Development

WATER COOLED AERO ENGINES (SIX YEARS' PROGRESS) *by A J Rowledge paper read before the Royal Aeronautical Society of Great Britain, February 27, 1930*

THE AUTHOR of this paper, Mr A J Rowledge was with the Wolseley Company at the outbreak of the war in 1914 From there he went to the Napier Company and had much to do with the designing of the RAF 3 engine Later Mr Rowledge designed the Napier Lion engine and continued in the capacity of a designer with the Napier firm until 1921 After this he joined Rolls Royce Ltd and at present he is principal assistant to Mr Royce Much interest was manifested over the reading of this paper since it was the first time that the general public had any inkling of the design features of the Rolls Royce type R engine which last year won the Schneider cup and set a world speed record of 357 7 m p h

Mr Rowledge's first point was that of reliability Reliability is the first and most vital thing which a designer should work for in any engine It is also the most difficult to achieve in the present engines in the light of the performance required of them

The paper stated that there is a general agreement that puts safety first above all things, but the commercial user of engines is not unreasonable in demanding in addition to safety a fairly long life and many hours of running without overhaul In achieving this the better control of cylinder temperatures in water cooled power plants is an important factor in allowing them to carry an overload. This has great significance in securing reliability, especially in planes using more than one engine, where if any safety factor is to be looked for, the remaining engine or engines should be capable of carrying the additional load when an emergency arises

As to the first cost, the cost per useful hp is what really matters A comparison between water and air cooled engines on this basis is not easy. As an example of the cost of overall he quoted the over-night change of the cylinder block of the Schneider trophy engine to prove that the cost need not be high Water cooled engines have lower fuel and oil consumption than air cooled A horsepower of 1900 and a weight of 1,530 lb, or 805 lb per hp is the record established by the Rolls Royce type R engine For maximum hp attained on the test stand it had a rating of 75 lb per hp Mr Rowledge emphasized the point that this was by no means the ideal and that these figures would be further improved with more study and experimentation The standard Rolls Royce type H engine is rated at 825 hp and yet has the same capacity as the racing engine This shows the necessity of restrained judgment in deciding between performance and reliability Mr Rowledge was also of the opinion that this indicates very definitely both the direction and the distance available for further improvement He was quite emphatic in his belief that future development will be toward the reduction of cylinder capacity on a given crank with high mean effective pressure and rate of crankshaft revolutions

He illustrated his point with figures for engines that have passed the British Air Ministry's type test These figures show that a naturally aspirated engine at its rated power has a b m e p of 133 lb and a moderate supercharger engine has a b m e p of 143 lb at its rated hp The latter figure compares in use with a high compression engine which has gate protection against an overload while on the ground The first of these engines above mentioned weighs 1 76 lb per hp and the second 1 71 lb per hp Both of these engines are geared and are complete with all accessories A normal engine on a capacity basis gives 37 8 hp per 100 cu in and the model supercharged engine 40 5 hp per 100 cu in At its maximum power the Schneider Trophy engine delivered 90 hp per 100 cu in

It is expected that engines of 1 000 hp may soon be in demand for transport work—those of 800 hp are already available Research and developments which are undertaken and made for the breaking or establishment of speed and distance records are of great value when applied to everyday transport operation

Mr Rowledge expressed his keen desire to see more attention paid to the adoption of three bladed propellers There is a general movement toward the use of gear reduction The weight and inertia of propellers as now manufactured must be reduced.

On water cooled type engines spur gearing is most often used in contrast to the use of epicyclic gears on air cooled types The use of spur gearing allows any desired ratio of speed to be obtained and brings the center line of the propeller into a better position The success of the spur gears, so used, is due largely to the very accurate grinding of the teeth A tooth face pressure of 3,400 lb per in with a pitch line velocity of 3,200 f p m. are commonly found

Steam cooling should be generally adopted during the next few years also the use of a fluid other than pure water, according to the author

Mr Rowledge believes that the wing condensers in a steam cooling system will be used to the exclusion of cooling units of any other type The cooling system of the airship R-101 is a notable example of this type A comparison of ethylene glycol used in place of water as a cooling medium is of little value at present but bears great possibilities

The variable pitch propeller is something to be highly desired but is still in the experimental stage and not yet practical If a wide enough range can be attained between the cruising speed and the maximum permissible speed of an engine the variable pitch propeller will lose most of its advantages and will not be worth using.

The most important development in recent years is the use of a geared centrifugal blower for supercharging In Great Britain it is the usual practice to place the carburetor on the suction side of the blower This keeps the float chamber low down on the engine, helps gravity feed and the fuel does not have to be fed against the booster pressure. The displacement type of blower promises to prove useful, while the exhaust driven type seems likely to fall completely into discard

A new form of supercharging developed by Rolls Royce, Ltd., is that in which the mouth of the intake is arranged to take the full velocity of the air driven against it and by means of expanding tube reduce its pressure and feed it to the carburetor This is the cheapest form yet developed

In the design of combustion space the builder is very badly hampered by the need to include sufficient valve area.

The least progress to date has been made toward engine silence. In this line the best example, and one on which the most success has been achieved, is probably the old six-in-line water cooled engine with a long exhaust pipe

The paper continued with a description of the Rolls Royce R engine. The bore and stroke are 6 in and 6½ in respectively. The blower capacity was greatly increased over that of the standard Rolls Royce H engine of the same size The outline has been altered to suit the nose of the racing machine. Weight of the latest magnetos has been greatly reduced by the use of cobalt chrome magnets

A new alloy known as R R T 50 L which in the cast form has an ultimate strength of 12 tons and an elongation of 3 to 8 per cent was used extensively Its specific gravity does not exceed 2.75 This material retains its strength at high temperatures The alloy also has good forging qualities Great advancement is to be noted in valve steels

Engine driven fuel pumps are now accepted as standard, with the gear and the diaphragm type holding the lead

Manufacturers in general are slow to adopt magnesium castings in place of aluminum It has been shown by experience that these castings are less affected by salt air than was previously supposed and have a fatigue strength less than aluminum castings in the usual alloys per square inch

THE BUYER'S LOG BOOK

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Elgin Panel

The Aircraft Instrument Division of the Elgin National Watch Company offers the industry a new panel Included are tachometer, air-speed, compass, altimeter, pressure gauge, thermometer, ice warning indicator, clock, and bank indicator

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G. E. Lighting Control

BY MEANS of a new central control station, just announced by the General Electric Co, the various lighting equipments of an airport can be operated from one point, thus eliminating the necessity of locating the lighting control at a place where the various lights themselves are visible The control panel may be placed on a wall, table or desk, or it may be mounted on a special pedestal The indicating lights are protected from damage by compound shields and each light is wired in the actual circuit controlled, providing an actual indication of the condition of that circuit —AVIATION, *May 24 1930*

Wind-Driven Generator

ELECTRIC Specialty Co Stamford, Conn, has recently developed a three-commutator, wind-driven generator in connection with a storage battery for use as a current supply for airplane radio apparatus while the plane is at rest as well as in the air Generators are being used with two commutators one to deliver high voltage for the radio transmitter, and the other to deliver low voltage for charging the storage battery and to furnish power to the filaments of the transmitting tubes

The three-commutators machine, according to the manufacturer, is designed so that it may be operated from the same storage battery which it charges, and deliver full high voltage output Thus full power may be obtained from the transmitter when the plane is on the ground and the main engine not in operation In this machine the high voltage commutator and winding are the same as in the ordinary two-commutator, double current generator —AVIATION, *May 24 1930*

Barlow Roller Fuel Pump

THE National Steel Products Co, Dayton Ohio Division of Aero Supply Mfg Co Inc is sole distributor of the new Barlow roller fuel pump to the aviation industry The pump built by McCord Radiator & Mfg Co of Detroit, has only six moving parts—four small steel rollers, the rotor which drives the rollers and the relief valve in the pump The mounting flange is the standard S A E aeronautic mounting

A single by-pass valve is used in this machine, and no pumping valves It is built to operate in either direction of rotation, but when assembled for clockwise rotation, will not function in the opposite direction Approximately 60 gal of gasoline per hr at 1 600 r p m are delivered —AVIATION, *May 24, 1930*

Airport Fueling System

THE "Aeropit" manufactured by Gilbelt & Barker Springfield Mass, provides a fueling system adaptable to any size or type of airport It is usually installed at the flying line, where it is convenient for planes to fuel Gasoline is supplied to the pit by an electric pumping unit placed in or near the hangar and operated from a switch in the pit The starting switch is operated by the foot and is so arranged that closing the pit covers automatically throws off the switch A hand water pump is provided in case water gets into the pit from flooded fields

Each pit has two compartments—the control compartment containing the meter, filter, motor switch and shut-off valve, and the hose compartment with a horizontal hose reel on which is coiled 50 ft of hose Since the hose can be taken out either side of the pit the fueling range is approximately 100 ft Gasoline served from the pit passes through a filter which removes dirt and sediment, and a displacement type meter measures the quantity dispensed The system is only 18 in deep, a factor which permits easy installation makes it easier to keep clean and lessens the possibility of gasoline fumes collecting —AVIATION, *May 24, 1930.*

TRADE CATALOGS

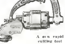
▶ *Westland IV Three-Engined Limousine* A bulletin descriptive of the Westland IV three-engined limousine has just been issued by the Westland Aircraft Works, Yeovil, England. The general design is briefly presented together with special features such as wireless equipment, heating and ventilation, standard instruments provided and night flying equipment

▶ *Apex Tools* A new catalog of the Apex Machine Co describes in detail the various types of quick change chucks, both positive and friction drive, for single and multiple spindle operations, and includes tools recently brought out, full floating and semi-floating holder floating tap sleeves and universal joint nut setters

▶ *"The Modern Fire Chief"* The March-April issue of this publication of American-LaFrance and Foamite Corp contains a section relating to airplane fires, which will be of interest to the aviation industry

Stanley-Unishear

A NEW MOTOR DRIVEN hand shear known as the Mighty Midget Unishear has been announced by the Stanley Electric Tool Company, New Britain, Conn Some of the materials cut by this tool, are rubber, veneer, asbestos, celluloid, linoleum, wire mesh, sheet iron and steel Operating from a lamp socket, the shear has a capacity of 18 U S gauge and lighter on sheet steel, 16 U S gauge on aluminum and brass and in the same proportion on softer materials The speed is up to 15 ft. per min and depends on the feeding of the operator The minimum radius of the shear is 1 in and equipped with an ¼ hp Westinghouse Universal motor it weighs 6½ lb —AVIATION, *May 24, 1930*



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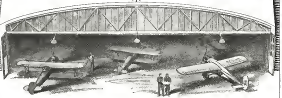

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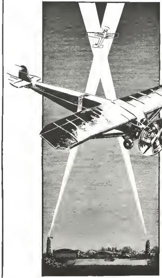

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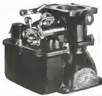

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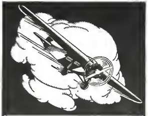

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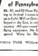
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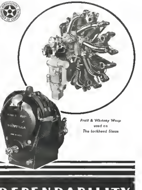

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Ordinary refining leaves in every gallon of oil, one quart or more that is of little or no value as a lubricant to your motor—a quart of waste

But you don't get that waste in any gallon of Quaker State—for Quaker State is not refined in the ordinary way. It is *super*-refined—carried a step further—by an exclusive Quaker State process that removes the quart of waste that ordinary refining leaves in In place of this quart of waste you get a quart of the finest *lubricant*—a quart *more* than you get in the gallon of ordinary oil. In fact, an *extra* quart!

And every quart in every gallon of Quaker State Aero Oil comes from fighting ancestry—every single quart of it. It's made from 100% pure Pennsylvania Grade Crude Oil, the finest the world produces, the finest "base" an aero oil can have

Ask for Quaker State Aero Oil at your airport. It's everything an aero oil should be. It gets right to work the moment your motor starts turning over. It stands up longer under heat. It won't grow soupy from hard use—and it will keep any motor singing with a sweeter, smoother hum. Try it!

Other Pure Pennsylvania Products are

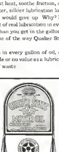
QUAKER STATE MEDIUM MOTOR OIL

QUAKER STATE MEDIUM HEAVY MOTOR OIL

QUAKER STATE HEAVY MOTOR OIL

QUAKER STATE COLD TEST

QUAKER STATE TRACTOR OILS



QUAKER STATE OIL REFINING CO., OIL CITY, PA

QUAKER STATE

TRADE MARK REG. U. S. PAT. OFF.

AERO OIL

Get that extra quart in every gallon

Taking the southern air with

PAN AMERICAN

THESE are days when business and pleasure are summoning thousands to Central and South America New markets and old culture beckon And whether the objects are trade or travel, Pan American Airways add keen delight to the journey.

Flying South with Pan American, you take off from Miami in the fast, comfortable Sikorsky Amphibions Powered with two "Wasp" 420 H. P. engines these luxurious ships can fly and maneuver on either engine They are converted from landplanes to seaplanes in a matter of seconds

The use of a sizeable fleet of Sikorsky Amphibions by Pan American is typical of the care with which this famous line provides for the complete comfort and swift transport of its patrons

And the Sikorsky Amphibion is equally valuable for use in the States With deep water much closer than landing fields to the business centers of many cities, the "S-38" is saving time for transport lines, business organizations and owners in private life A folder, recently issued, has some interesting things to say on this point. May we send you a copy? Sikorsky Aviation Corporation, Bridgeport, Connecticut Division of United Aircraft & Transport Corporation

Photo Fairchild [illegible]

Pan American's panorama varies from urban Miami to the densely wooded tropic wilds

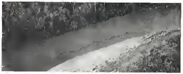
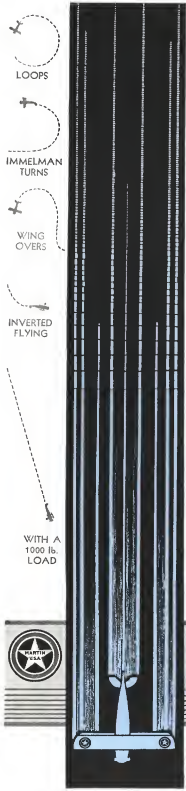


Photo by Johnson Brothers

SIKORSKY AMPHIBION



A 6,000 Foot Dive
and pursuit acrobatics with a
1,000 lb. Bomb Load

Twelve thousand feet above the Naval Air Station, Anacostia, D. C., the new Martin Bomber XT5M-1 poised for a test dive—carrying a 1000 lb. bomb in the usual military way. Up went its tail and the powerful plane plunged toward the earth! For over 6000 feet it hurtled down in a vertical line—and then, at a terminal velocity of more than 4 miles per minute, pilot Wm. H. MacAvoy pulled out sharply from the dive with the bomb still in place. Over and over again, this record-making feat was performed.

Still carrying the 1000 lb. load, this mighty bomber executed manoeuvres expected only of pursuit planes. Aerobatics such as loops, Immelmans, wing-overs and inverted flying were accomplished with an ease and grace that astonished the experts assembled to witness this remarkable test. Although numerous unsuccessful attempts have been made by others, these feats have never before been performed by any airplane in any country.

Significant of the Martin Company's manufacturing dependability is the fact that it was chosen to build this great plane by the U. S. Government, which excels all other nations of the world in aircraft research. The aerodynamical design and arrangement of the Martin XT5M-1 were ably engineered by the Bureau of Aeronautics of the U. S. Navy. The structural and detail design was developed by the Martin Company.

The New Martin Bomber XT5M-1

MARTIN AIRCRAFT

THE GLENN L. MARTIN COMPANY

Builders of Dependable Aircraft Since 1909

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